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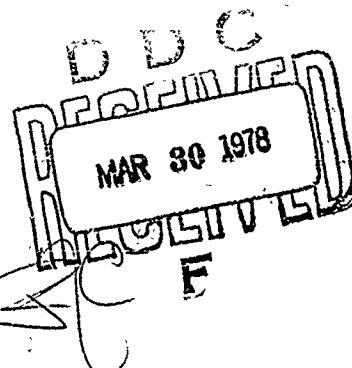
REPORT NO. QAR-Q-011

COMPUTER SIMULATION OF MAXIMUM  
LIKELIHOOD OUTPUT FOR STANDARD

LANGLIE TEST  
( $n=12$ )

DONALD C. RAPPAPORT

DECEMBER 1977



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PRODUCT ASSURANCE DIRECTORATE

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND  
DOVER, NEW JERSEY

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LIKELIHOOD OUTPUT FOR STANDARD  
LANGLIE TEST  
( $n=12$ )<sub>9</sub>

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## I. Discussion

The purpose of this report is to give an accounting of the efficiency and reliability of the sample statistics derived from the Langlie Sensitivity Test using the maximum likelihood method in obtaining an average penetration velocity (V50) and a standard deviation of the penetration velocity.

The assumption is made that the probability of obtaining a penetration is distributed as the cumulative normal probability distribution. The maximum likelihood method in theory will give the most likely estimates of the average and standard deviation of this normal curve.

The test procedure begins with estimates of those levels at which failure and success have highly likely probabilities of occurrence. These estimates have little credibility. If they were good estimates, the test would not have to be conducted. This report shows the expected results with estimates, referred to as gates, of varying size around the true average.

The Langlie Test Procedure is defined in detail in Appendix A. A computer program was prepared simulating test results using this procedure. The true population was defined as being a cumulative normal distribution with an average of zero and a standard deviation of one. Each of the sample distributions shown were derived by using different starting estimates in terms of the standard deviation.

Hopefully, these tables will provide insight in the use and application of this procedure.

## II. Sample Statistics: Maximum Likelihood Method

Most of this section is devoted to computer printouts of distributions of sample averages and sample standard deviations. An attempt was made in Figure 2-1 to summarize some of the accumulated data. It is the author's opinion that the summary hides much of the information contained in the printouts because the distributions do not conform to standard probability distribution curves, therefore although these printouts are bulky, they are included.

The author has been advised by Ms. Kodat<sup>A</sup> of Aberdeen Proving Ground, that the standard deviation (for the standard test) should be divided by .745 in order to unbiased the results.

From Figure 2-1, it is noted that as the initial gates get closer the variation or standard deviation of the standard deviation increases per unit average standard deviation (under Standard Deviation, see Standard Deviation/Average). The statistics were obtained from the grouped data on the printouts. It is assumed that part of the reason the Average of the estimated averages all tend to be negative is that the estimates that are exactly zero are in the group labeled -.10 to .00 and that some of the tables were computed using the same random number set.

As stated previously, these tables were generated to provide some insight in the analysis of sample estimates of penetration data to the user of the Langlie Test Procedure. Some applications are discussed in Section VIII of this report.

A. Author of the modified computer program used to calculate the maximum likelihood average and standard deviation.

# Selected Summary of Computer Printouts

	Initial Estimates (In standard deviations)					
	-5 to +5	-2 to +3	-2 to +2	-1 to +2	0 to +2	-0.5 to +0.5
Averages						
Average	-.01	-.01	-.03	-.03	-.05	-.04
Standard Deviation	.40	.39	.39	.38	.61	.42
Number of values used from printout	829	827	886	849	467	757
Number of extreme values not used	0	0	0	1	21	4
Standard Deviations						
Average	.77	.69	.71	.61	.77	.39
Standard Deviation	.42	.38	.51	.49	.85	.47
Number of values used from printout	829	825	884	844	463	753
Number of extreme values not used	0	2	2	6	25	8
Standard Deviation/Average	.55	.70	.72	.80	1.10	1.21
Total Simulations Attempted	1000	1000	1000	1000	1000	1000
Number of simulations not used due to						
No overlap	135	95	65	53	68	52
Iterative process failed	36	78	49	97	444	187

Fig. 2-1

3

THE DATA REPRESENTED BELOW HAS A TRUE STD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEI SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 100 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 0.00 AND .50 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVRAGES

INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.0	1.1	1.1	-1.10 TO -1.00	2.0	3.7	3.7
-2.90 TO -2.80	0.0	1.1	1.1	-1.00 TO -.90	1.0	3.9	3.9
-2.80 TO -2.70	0.0	1.1	1.1	-.90 TO -.80	1.0	4.2	4.2
-2.70 TO -2.60	0.0	1.1	1.1	-.80 TO -.70	2.0	4.8	4.8
-2.60 TO -2.50	0.0	1.1	1.1	-.70 TO -.60	6.0	6.5	6.5
-2.50 TO -2.40	0.0	1.1	1.1	-.60 TO -.50	5.0	7.9	7.9
-2.40 TO -2.30	0.0	1.1	1.1	-.50 TO -.40	6.0	9.6	9.6
-2.30 TO -2.20	1.0	1.4	1.4	-.40 TO -.30	5.0	11.0	11.0
-2.20 TO -2.10	0.0	1.4	1.4	-.30 TO -.20	7.0	12.9	12.9
-2.10 TO -2.00	0.0	1.4	1.4	-.20 TO -.10	7.0	14.9	14.9
-2.00 TO -1.90	0.0	1.4	1.4	-.10 TO .00	56.0	30.6	30.6
-1.90 TO -1.80	0.0	1.4	1.4	.00 TO .10	130.0	67.1	67.1
-1.80 TO -1.70	3.0	2.2	2.2	.10 TO .20	73.0	87.6	87.6
-1.70 TO -1.60	0.0	2.2	2.2	.20 TO .30	32.0	96.6	96.6
-1.60 TO -1.50	3.0	3.1	3.1	.30 TO .40	9.0	99.2	99.2
-1.50 TO -1.40	0.0	3.1	3.1	.40 TO .50	2.0	99.7	99.7
-1.40 TO -1.30	0.0	3.1	3.1	.50 TO .60	0.0	99.7	99.7
-1.30 TO -1.20	0.0	3.1	3.1	.60 TO .70	0.0	99.7	99.7
-1.20 TO -1.10	0.0	3.1	3.1	.70 TO .80	0.0	99.7	99.7

# STANDARD DEVIATIONS

INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.0	0.0	0.0	-1.10 TO -1.00	0.0	0.0	0.0
-2.90 TO -2.80	0.0	0.0	0.0	-1.00 TO -.90	0.0	0.0	0.0
-2.80 TO -2.70	0.0	0.0	0.0	-.90 TO -.80	0.0	0.0	0.0
-2.70 TO -2.60	0.0	0.0	0.0	-.80 TO -.70	0.0	0.0	0.0
-2.60 TO -2.50	0.0	0.0	0.0	-.70 TO -.60	0.0	0.0	0.0
-2.50 TO -2.40	0.0	0.0	0.0	-.60 TO -.50	0.0	0.0	0.0
-2.40 TO -2.30	0.0	0.0	0.0	-.50 TO -.40	0.0	0.0	0.0
-2.30 TO -2.20	0.0	0.0	0.0	-.40 TO -.30	0.0	0.0	0.0
-2.20 TO -2.10	0.0	0.0	0.0	-.30 TO -.20	0.0	0.0	0.0
-2.10 TO -2.00	0.0	0.0	0.0	-.20 TO -.10	0.0	0.0	0.0
-2.00 TO -1.90	0.0	0.0	0.0	-.10 TO .00	0.0	0.0	0.0
-1.90 TO -1.80	0.0	0.0	0.0	.00 TO .10	82.0	23.0	23.0
-1.80 TO -1.70	0.0	0.0	0.0	.10 TO .20	62.0	40.4	40.4
-1.70 TO -1.60	0.0	0.0	0.0	.20 TO .30	72.0	60.7	60.7
-1.60 TO -1.50	0.0	0.0	0.0	.30 TO .40	32.0	69.7	69.7
-1.50 TO -1.40	0.0	0.0	0.0	.40 TO .50	23.0	76.1	76.1
-1.40 TO -1.30	0.0	0.0	0.0	.50 TO .60	19.0	81.5	81.5
-1.30 TO -1.20	0.0	0.0	0.0	.60 TO .70	7.0	83.4	83.4
-1.20 TO -1.10	0.0	0.0	0.0	.70 TO .80	3.0	84.3	84.3

NUMBER OF TIMES IN 1000 IN WHICH

- THERE WAS NO OVERLAP----- 50
- ITERATIVE PROCESS FAILED- 585

Fy 2-24

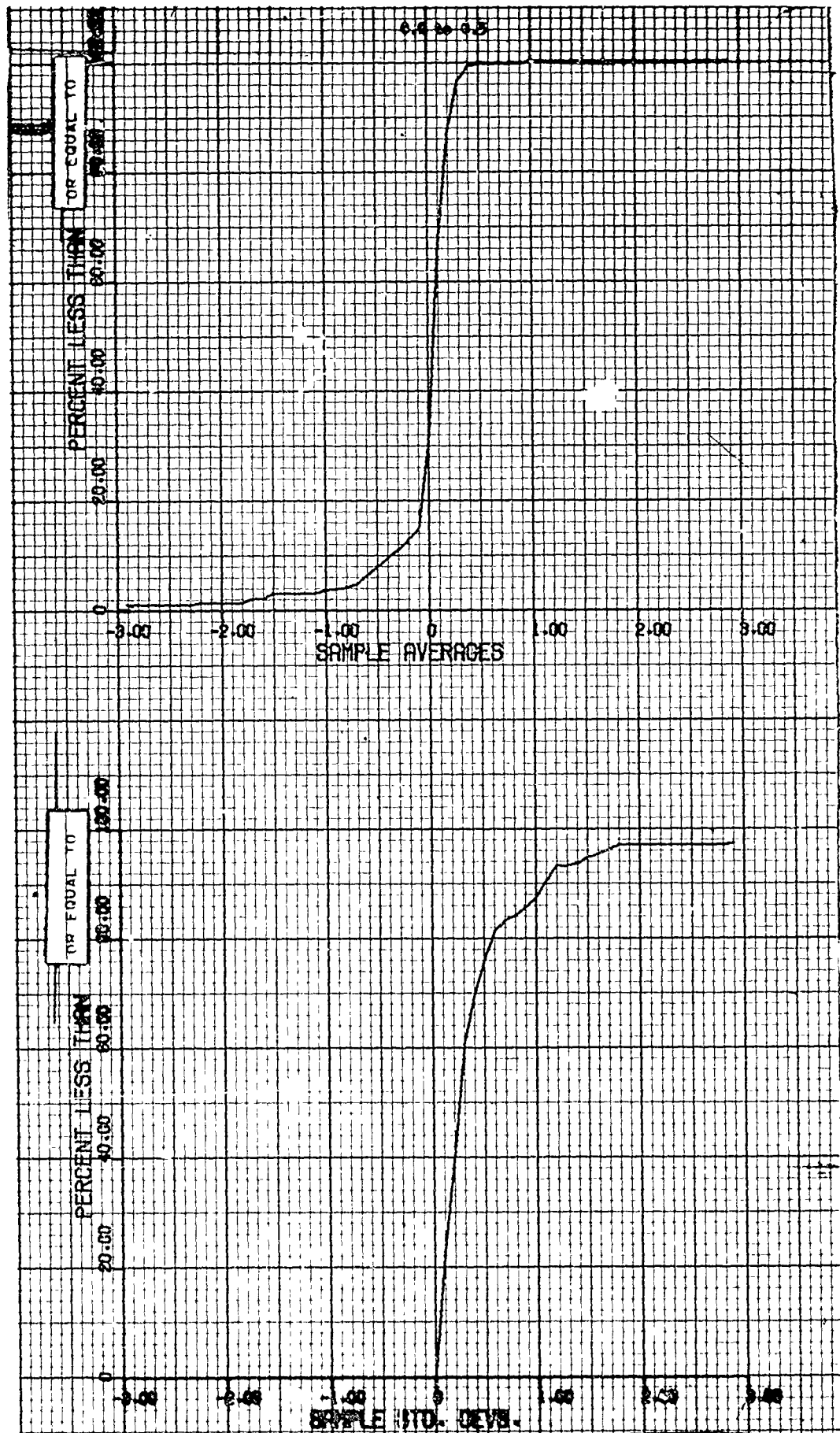


Fig 2-28



\*\*\*\*\*  
 THE DATA REPRESENTED BELOW HAS A TRUE STD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LARGEST SENSITIVITY  
 TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -.50 AND .50 RESPECTIVELY.  
 THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.  
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# AVERAGES

INTERVAL	FFD CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	
-3.00 TO -2.90	0.	-1.10 TO -1.00	2.	-.80 TO -.90	1.	98.3	2.70 TO 2.80	0.
-2.90 TO -2.80	0.	-1.00 TO -.90	1.	-.90 TO -1.00	0.	98.3	2.80 TO 2.90	1.
-2.80 TO -2.70	1.	-.90 TO -.80	1.	1.00 TO 1.10	0.	98.3	2.90 TO 3.00	0.
-2.70 TO -2.60	0.	-.80 TO -.70	0.	1.10 TO 1.20	0.	98.3	3.00 TO 3.10	0.
-2.60 TO -2.50	0.	-.70 TO -.60	4.	1.20 TO 1.30	5.	98.9	3.10 TO 3.20	0.
-2.50 TO -2.40	0.	-.60 TO -.50	3.	1.30 TO 1.40	1.	99.1	3.20 TO 3.30	0.
-2.40 TO -2.30	0.	-.50 TO -.40	31.	1.40 TO 1.50	0.	99.1	3.30 TO 3.40	0.
-2.30 TO -2.20	0.	-.40 TO -.30	63.	1.50 TO 1.60	0.	99.1	3.40 TO 3.50	0.
-2.20 TO -2.10	0.	-.30 TO -.20	104.	1.60 TO 1.70	0.	99.1	3.50 TO 3.60	0.
-2.10 TO -2.00	0.	-.20 TO -.10	94.	1.70 TO 1.80	1.	99.2	3.60 TO 3.70	0.
-2.00 TO -1.90	0.	-.10 TO .00	128.	1.80 TO 1.90	0.	99.2	3.70 TO 3.80	0.
-1.90 TO -1.80	0.	.00 TO .10	137.	1.90 TO 2.00	0.	99.2	3.80 TO 3.90	0.
-1.80 TO -1.70	1.	.10 TO .20	101.	2.00 TO 2.10	0.	99.2	3.90 TO 4.00	0.
-1.70 TO -1.60	0.	.20 TO .30	31.	2.10 TO 2.20	0.	99.2	4.00 TO 4.10	0.
-1.60 TO -1.50	1.	.30 TO .40	20.	2.20 TO 2.30	0.	99.2	4.10 TO 4.20	0.
-1.50 TO -1.40	0.	.40 TO .50	6.	2.30 TO 2.40	0.	99.2	4.20 TO 4.30	1.
-1.40 TO -1.30	0.	.50 TO .60	4.	2.40 TO 2.50	0.	99.2	4.30 TO 4.40	0.
-1.30 TO -1.20	1.	.60 TO .70	2.	2.50 TO 2.60	0.	99.2	4.40 TO 4.50	2.
-1.20 TO -1.10	1.	.70 TO .80	0.	2.60 TO 2.70	0.	99.2	4.50 TO 4.60	0.
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# STANDARD DEVIATIONS

INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	
-3.00 TO -2.90	0.	-1.10 TO -1.00	0.	-.80 TO -.90	30.	91.9	2.70 TO 2.80	1.
-2.90 TO -2.80	0.	-1.00 TO -.90	0.	-.90 TO -1.00	5.	92.5	2.80 TO 2.90	4.
-2.80 TO -2.70	0.	-.90 TO -.80	0.	1.00 TO 1.10	11.	94.0	2.90 TO 3.00	1.
-2.70 TO -2.60	0.	-.80 TO -.70	0.	1.10 TO 1.20	3.	94.3	3.00 TO 3.10	0.
-2.60 TO -2.50	0.	-.70 TO -.60	0.	1.20 TO 1.30	2.	94.6	3.10 TO 3.20	0.
-2.50 TO -2.40	0.	-.60 TO -.50	0.	1.30 TO 1.40	2.	94.9	3.20 TO 3.30	0.
-2.40 TO -2.30	0.	-.50 TO -.40	0.	1.40 TO 1.50	3.	95.3	3.30 TO 3.40	1.
-2.30 TO -2.20	0.	-.40 TO -.30	0.	1.50 TO 1.60	2.	95.5	3.40 TO 3.50	0.
-2.20 TO -2.10	0.	-.30 TO -.20	0.	1.60 TO 1.70	4.	96.1	3.50 TO 3.60	0.
-2.10 TO -2.00	0.	-.20 TO -.10	0.	1.70 TO 1.80	2.	96.3	3.60 TO 3.70	1.
-2.00 TO -1.90	0.	-.10 TO .00	0.	1.80 TO 1.90	0.	96.3	3.70 TO 3.80	0.
-1.90 TO -1.80	0.	.00 TO .10	130.	1.90 TO 2.00	3.	96.7	3.80 TO 3.90	0.
-1.80 TO -1.70	0.	.10 TO .20	180.	2.00 TO 2.10	2.	97.0	3.90 TO 4.00	0.
-1.70 TO -1.60	0.	.20 TO .30	137.	2.10 TO 2.20	2.	97.2	4.00 TO 4.10	0.
-1.60 TO -1.50	0.	.30 TO .40	80.	2.20 TO 2.30	0.	97.2	4.10 TO 4.20	0.
-1.50 TO -1.40	0.	.40 TO .50	66.	2.30 TO 2.40	1.	97.4	4.20 TO 4.30	0.
-1.40 TO -1.30	0.	.50 TO .60	41.	2.40 TO 2.50	1.	97.5	4.30 TO 4.40	0.
-1.30 TO -1.20	0.	.60 TO .70	25.	2.50 TO 2.60	1.	97.6	4.40 TO 4.50	0.
-1.20 TO -1.10	0.	.70 TO .80	10.	2.60 TO 2.70	2.	97.9	4.50 TO 4.60	0.
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NUMBER OF TIMES IN 1000 IN WHICH  
 1. THERE WAS NO OVERLAP----- 52  
 2. ITERATIVE PROCESS FAILED- 187

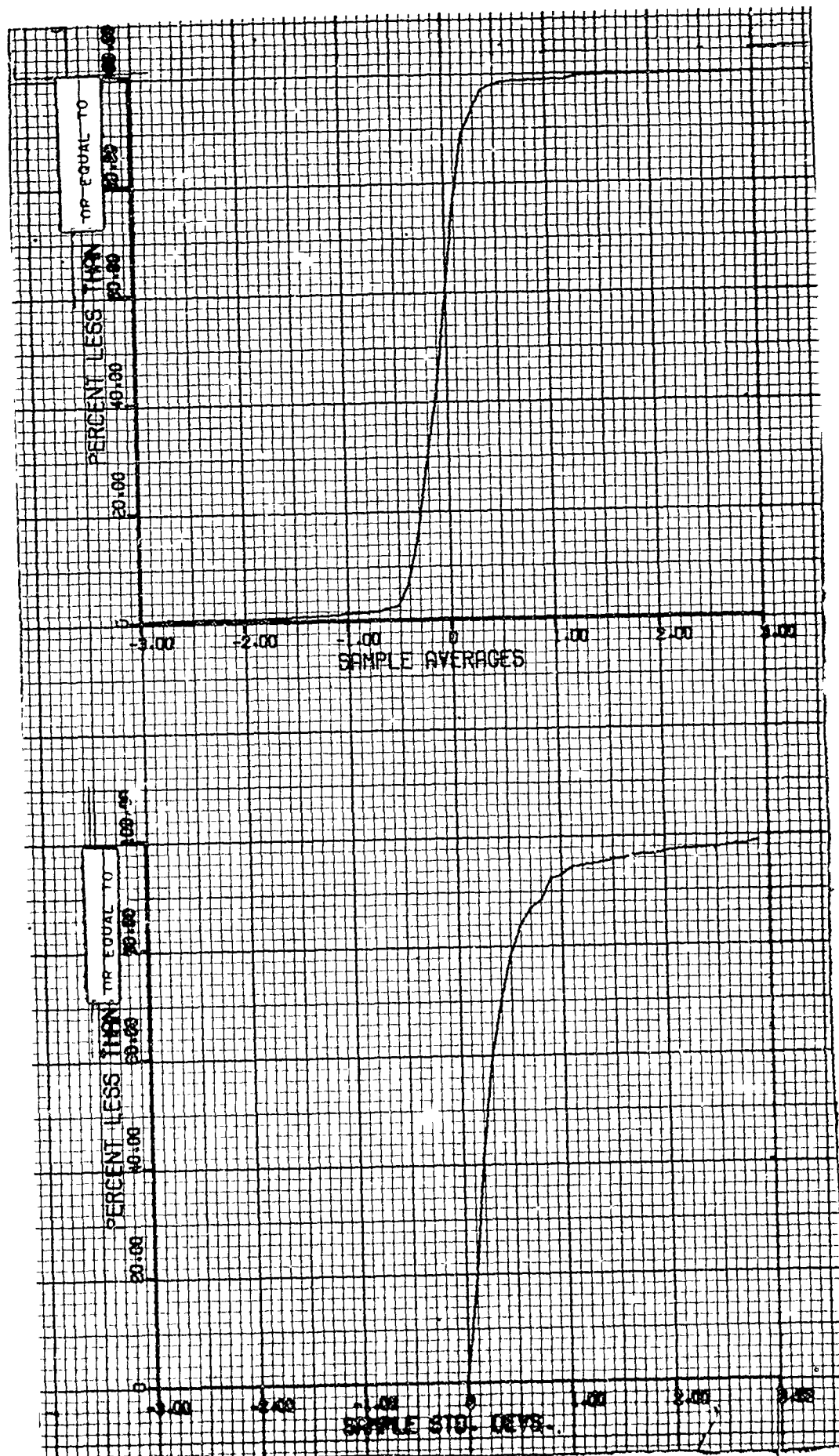


Fig. 2-4

THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 0.00 AND 1.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FRFO	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	1.4	-1.10 TO -1.00	2	7.8	-.80 TO -.90	0	99.8	2.70 TO 2.80	0	99.8
-2.90 TO -2.80	0	1.4	-1.00 TO -.90	1	8.1	-.90 TO -1.00	0	99.8	2.80 TO 2.90	0	99.8
-2.80 TO -2.70	0	1.4	-.90 TO -.80	7	9.7	1.00 TO 1.10	0	99.8	2.90 TO 3.00	0	99.8
-2.70 TO -2.60	0	1.4	-.80 TO -.70	4	10.6	1.10 TO 1.20	0	99.8	3.00 TO 3.10	0	99.8
-2.60 TO -2.50	0	1.4	-.70 TO -.60	2	11.1	1.20 TO 1.30	0	99.8	3.10 TO 3.20	0	99.8
-2.50 TO -2.40	0	1.4	-.60 TO -.50	3	11.8	1.30 TO 1.40	0	99.8	3.20 TO 3.30	0	99.8
-2.40 TO -2.30	0	1.4	-.50 TO -.40	3	12.4	1.40 TO 1.50	0	99.8	3.30 TO 3.40	0	99.8
-2.30 TO -2.20	1	1.6	-.40 TO -.30	4	13.4	1.50 TO 1.60	0	99.8	3.40 TO 3.50	0	99.8
-2.20 TO -2.10	2	2.1	-.30 TO -.20	5	14.5	1.60 TO 1.70	0	99.8	3.50 TO 3.60	0	99.8
-2.10 TO -2.00	0	2.1	-.20 TO -.10	33	22.1	1.70 TO 1.80	0	99.8	3.60 TO 3.70	0	99.8
-2.00 TO -1.90	2	2.5	-.10 TO .00	47	32.4	1.80 TO 1.90	0	99.8	3.70 TO 3.80	0	99.8
-1.90 TO -1.80	2	3.0	.00 TO .10	96	55.1	1.90 TO 2.00	0	99.8	3.80 TO 3.90	0	99.8
-1.80 TO -1.70	0	3.0	.10 TO .20	98	77.6	2.00 TO 2.10	0	99.8	3.90 TO 4.00	0	99.8
-1.70 TO -1.60	5	4.1	.20 TO .30	42	87.3	2.10 TO 2.20	0	99.8	4.00 TO 4.10	0	99.8
-1.60 TO -1.50	3	4.8	.30 TO .40	22	92.4	2.20 TO 2.30	0	99.8	4.10 TO 4.20	0	99.8
-1.50 TO -1.40	1	5.1	.40 TO .50	23	97.7	2.30 TO 2.40	0	99.8	4.20 TO 4.30	0	99.8
-1.40 TO -1.30	2	5.5	.50 TO .60	3	98.4	2.40 TO 2.50	0	99.8	4.30 TO 4.40	0	99.8
-1.30 TO -1.20	5	6.7	.60 TO .70	6	99.8	2.50 TO 2.60	0	99.8	4.40 TO 4.50	0	99.8
-1.20 TO -1.10	3	7.4	.70 TO .80	0	99.8	2.60 TO 2.70	0	99.8	4.50 TO 4.60	0	99.8

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	-.80 TO -.90	12	80.6	2.70 TO 2.80	3	94.5
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	-.90 TO -1.00	13	83.6	2.80 TO 2.90	4	95.4
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	1.00 TO 1.10	3	84.3	2.90 TO 3.00	1	95.6
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	1.10 TO 1.20	3	85.0	3.00 TO 3.10	1	95.9
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	1.20 TO 1.30	0	85.0	3.10 TO 3.20	2	96.3
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	1.30 TO 1.40	1	85.3	3.20 TO 3.30	0	96.3
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	1.40 TO 1.50	1	85.5	3.30 TO 3.40	4	97.2
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	1.50 TO 1.60	0	85.5	3.40 TO 3.50	0	97.2
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	1.60 TO 1.70	2	85.9	3.50 TO 3.60	0	97.2
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	1.70 TO 1.80	4	86.9	3.60 TO 3.70	2	97.7
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	1.80 TO 1.90	0	86.9	3.70 TO 3.80	1	97.9
-1.90 TO -1.80	0	0.0	.00 TO .10	42	97.7	1.90 TO 2.00	2	87.3	3.80 TO 3.90	0	97.9
-1.80 TO -1.70	0	0.0	.10 TO .20	77	27.4	2.00 TO 2.10	6	88.7	3.90 TO 4.00	1	98.2
-1.70 TO -1.60	0	0.0	.20 TO .30	64	42.2	2.10 TO 2.20	7	90.3	4.00 TO 4.10	0	98.2
-1.60 TO -1.50	0	0.0	.30 TO .40	41	51.6	2.20 TO 2.30	2	90.8	4.10 TO 4.20	0	98.2
-1.50 TO -1.40	0	0.0	.40 TO .50	49	62.9	2.30 TO 2.40	3	91.5	4.20 TO 4.30	0	98.2
-1.40 TO -1.30	0	0.0	.50 TO .60	31	70.0	2.40 TO 2.50	4	92.4	4.30 TO 4.40	0	98.2
-1.30 TO -1.20	0	0.0	.60 TO .70	14	73.3	2.50 TO 2.60	2	92.9	4.40 TO 4.50	0	98.2
-1.20 TO -1.10	0	0.0	.70 TO .80	20	77.9	2.60 TO 2.70	4	93.8	4.50 TO 4.60	1	98.4

NUMBER OF TIMES IN 1000 IN WHICH

A. THERE WAS NO OVERLAP----- 56

R. ITERATIVE PROCESS FAILED- 510

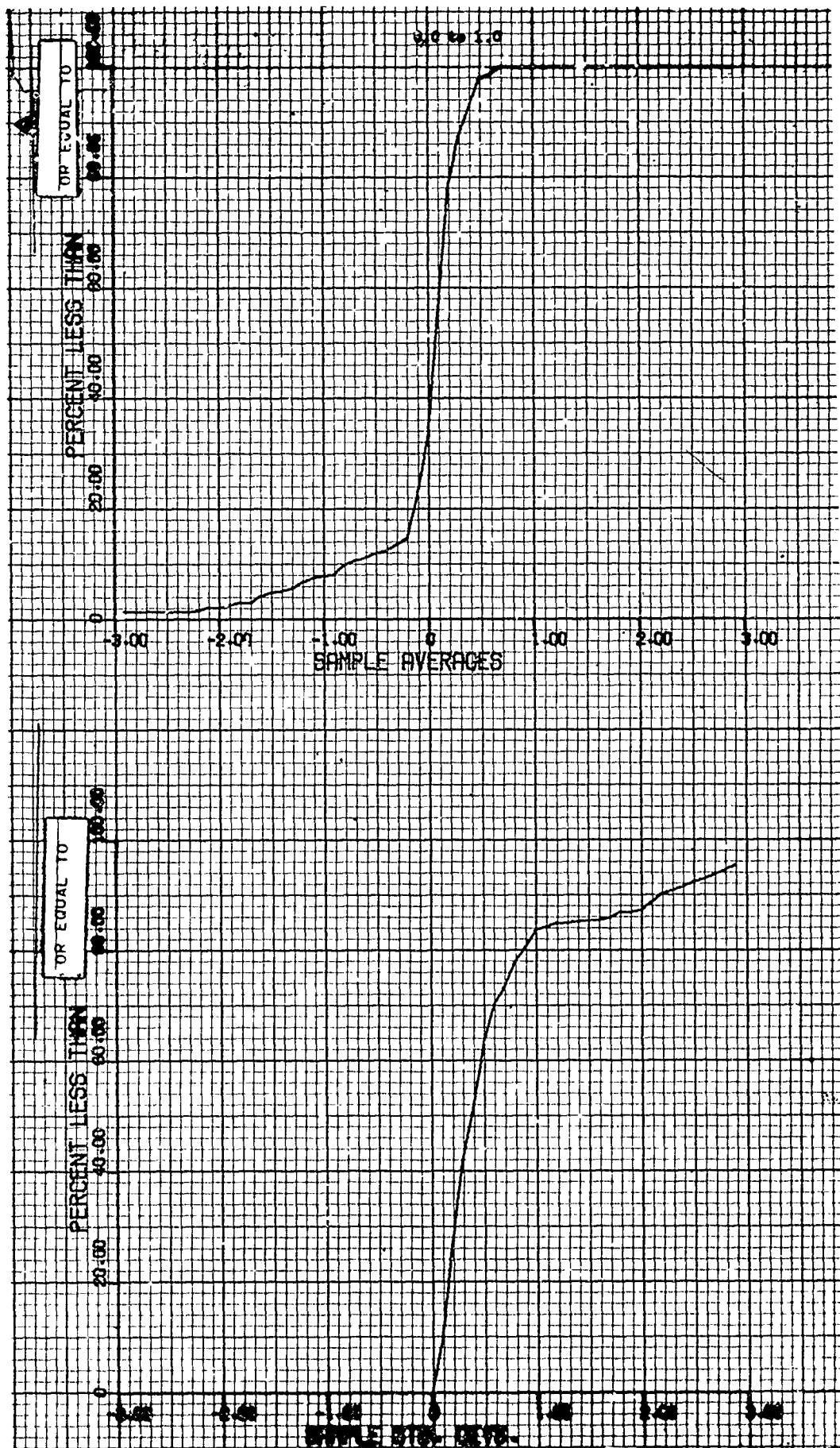


Fig 2-6

THE DATA REPRESENTED BELOW HAS A TRUE STD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -.50 AND 1.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	2	.6	-1.10 TO -1.00	1	1.5	.80 TO .90	1	99.9	2.70 TO 2.8	0	99.9
-2.90 TO -2.80	0	.6	-1.00 TO -.90	0	1.5	.90 TO 1.00	0	99.9	2.80 TO 2.9	0	99.9
-2.80 TO -2.70	1	.8	-.90 TO -.80	0	1.5	1.00 TO 1.10	0	99.9	2.90 TO 3.00	0	99.9
-2.70 TO -2.60	0	.8	-.80 TO -.70	2	1.8	1.10 TO 1.20	0	99.9	3.00 TO 3.10	0	99.9
-2.60 TO -2.50	0	.8	-.70 TO -.60	3	2.2	1.20 TO 1.30	0	99.9	3.10 TO 3.20	0	99.9
-2.50 TO -2.40	0	.8	-.60 TO -.50	11	3.6	1.30 TO 1.40	0	99.9	3.20 TO 3.30	0	99.9
-2.40 TO -2.30	0	.8	-.50 TO -.40	25	6.8	1.40 TO 1.50	0	99.9	3.30 TO 3.40	0	99.9
-2.30 TO -2.20	0	.8	-.40 TO -.30	65	15.2	1.50 TO 1.60	0	99.9	3.40 TO 3.50	0	99.9
-2.20 TO -2.10	0	.8	-.30 TO -.20	72	24.5	1.60 TO 1.70	0	99.9	3.50 TO 3.60	0	99.9
-2.10 TO -2.00	0	.8	-.20 TO -.10	104	37.8	1.70 TO 1.80	0	99.9	3.60 TO 3.70	0	99.9
-2.00 TO -1.90	0	.8	-.10 TO .00	103	51.1	1.80 TO 1.90	0	99.9	3.70 TO 3.80	0	99.9
-1.90 TO -1.80	2	1.0	.00 TO .10	101	64.1	1.90 TO 2.00	0	99.9	3.80 TO 3.90	0	99.9
-1.80 TO -1.70	0	1.0	.10 TO .20	121	79.7	2.00 TO 2.10	0	99.9	3.90 TO 4.00	0	99.9
-1.70 TO -1.60	1	1.2	.20 TO .30	62	87.6	2.10 TO 2.20	0	99.9	4.00 TO 4.10	0	99.9
-1.60 TO -1.50	0	1.2	.30 TO .40	48	93.8	2.20 TO 2.30	0	99.9	4.10 TO 4.20	0	99.9
-1.50 TO -1.40	2	1.4	.40 TO .50	25	97.0	2.30 TO 2.40	0	99.9	4.20 TO 4.30	0	99.9
-1.40 TO -1.30	0	1.4	.50 TO .60	11	98.5	2.40 TO 2.50	0	99.9	4.30 TO 4.40	0	99.9
-1.30 TO -1.20	0	1.4	.60 TO .70	5	99.1	2.50 TO 2.60	0	99.9	4.40 TO 4.50	0	99.9
-1.20 TO -1.10	0	1.4	.70 TO .80	5	99.7	2.60 TO 2.70	0	99.9	4.50 TO 4.60	0	99.9

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	.80 TO .90	19	89.1	2.70 TO 2.80	1	97.8
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	.90 TO 1.00	19	91.5	2.80 TO 2.90	3	98.2
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	1.00 TO 1.10	8	92.5	2.90 TO 3.00	1	98.3
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	1.10 TO 1.20	6	93.3	3.00 TO 3.10	0	98.3
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	1.20 TO 1.30	5	94.0	3.10 TO 3.20	0	98.3
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	1.30 TO 1.40	9	95.1	3.20 TO 3.30	1	98.5
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	1.40 TO 1.50	3	95.5	3.30 TO 3.40	0	98.5
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	1.50 TO 1.60	3	95.9	3.40 TO 3.50	2	98.7
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	1.60 TO 1.70	4	96.4	3.50 TO 3.60	0	98.7
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	1.70 TO 1.80	4	96.9	3.60 TO 3.70	0	98.7
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	1.80 TO 1.90	1	97.0	3.70 TO 3.80	0	98.7
-1.90 TO -1.80	0	0.0	.00 TO .10	112	14.4	1.90 TO 2.00	1	97.4	3.80 TO 3.90	0	98.7
-1.80 TO -1.70	0	0.0	.10 TO .20	123	30.2	2.00 TO 2.10	0	97.4	3.90 TO 4.00	0	98.7
-1.70 TO -1.60	0	0.0	.20 TO .30	125	46.3	2.10 TO 2.20	0	97.4	4.00 TO 4.10	2	99.0
-1.60 TO -1.50	0	0.0	.30 TO .40	99	59.1	2.20 TO 2.30	0	97.4	4.10 TO 4.20	1	99.1
-1.50 TO -1.40	0	0.0	.40 TO .50	80	69.4	2.30 TO 2.40	1	97.6	4.20 TO 4.30	1	99.2
-1.40 TO -1.30	0	0.0	.50 TO .60	51	75.9	2.40 TO 2.50	0	97.6	4.30 TO 4.40	1	99.4
-1.30 TO -1.20	0	0.0	.60 TO .70	50	82.4	2.50 TO 2.60	1	97.7	4.40 TO 4.50	1	99.5
-1.20 TO -1.10	0	0.0	.70 TO .80	33	86.6	2.60 TO 2.70	0	97.7	4.50 TO 4.60	0	99.5

NUMBER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 48
- B. ITERATIVE PROCESS FAILED- 175

Fig 2-1

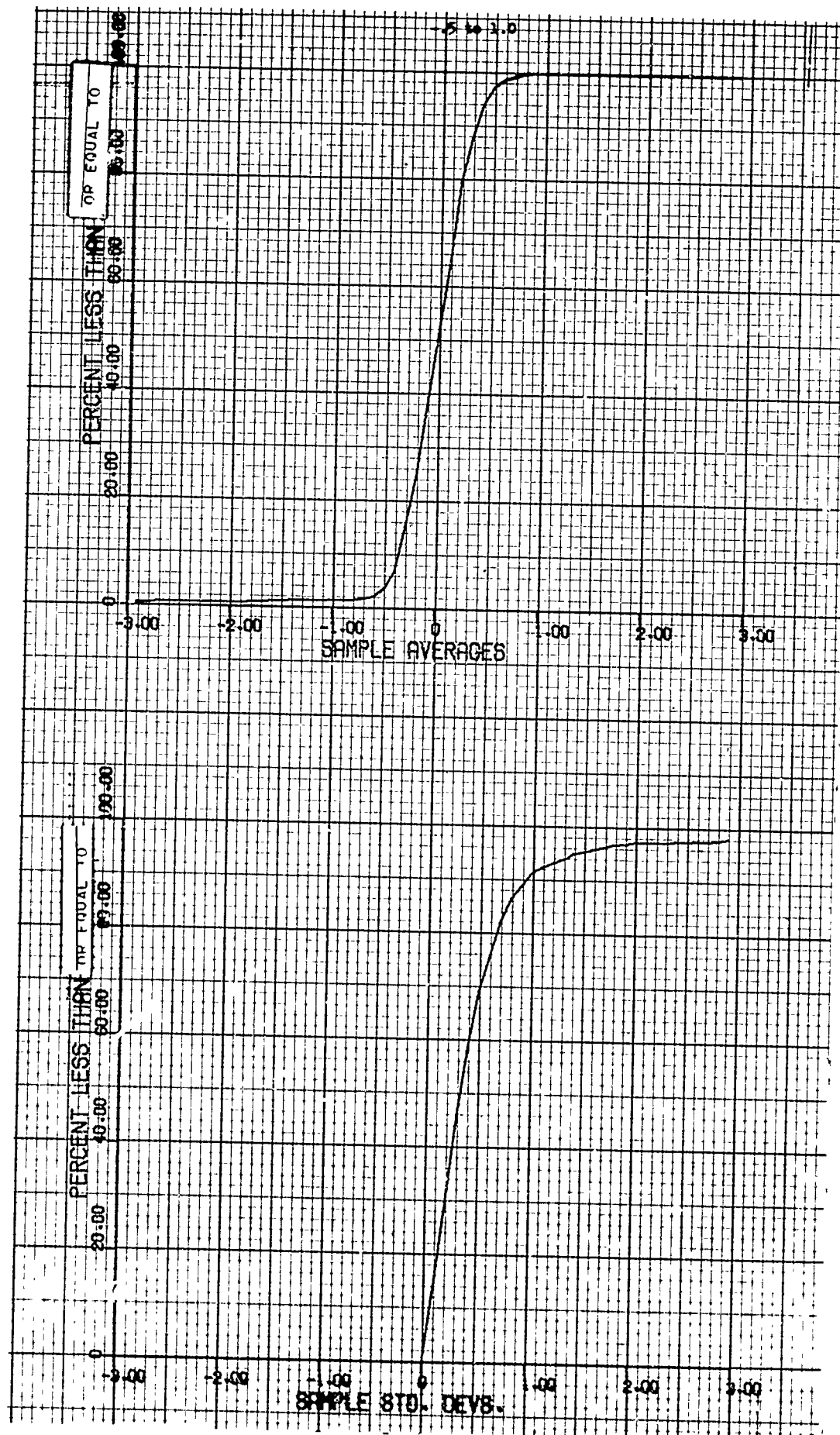


Fig 2-8

THE DATA REPRESENTED BELOW HAS A TRUE  $\mu$  OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -1.00 AND 1.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FRQO CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FRFO CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.1	-1.10 TO -1.00	0.4	.80 TO .90	1.99.2	2.70 TO 2.80	0.99.9
-2.90 TO -2.80	0.1	-1.00 TO -.90	0.4	.90 TO 1.00	1.99.3	2.80 TO 2.90	0.99.9
-2.80 TO -2.70	0.1	-.90 TO -.80	1.7	1.00 TO 1.10	3.99.6	2.90 TO 3.00	0.99.9
-2.70 TO -2.60	0.1	-.80 TO -.70	15.	1.10 TO 1.20	0.99.6	3.00 TO 3.10	0.99.9
-2.60 TO -2.50	0.1	-.70 TO -.60	15.	1.20 TO 1.30	0.99.6	3.10 TO 3.20	0.99.9
-2.50 TO -2.40	0.1	-.60 TO -.50	38.	1.30 TO 1.40	1.99.8	3.20 TO 3.30	0.99.9
-2.40 TO -2.30	1.2	-.50 TO -.40	51.	1.40 TO 1.50	0.99.8	3.30 TO 3.40	0.99.9
-2.30 TO -2.20	0.2	-.40 TO -.30	45.	1.50 TO 1.60	0.99.8	3.40 TO 3.50	0.99.9
-2.20 TO -2.10	0.2	-.30 TO -.20	89.	1.60 TO 1.70	0.99.8	3.50 TO 3.60	0.99.9
-2.10 TO -2.00	0.2	-.20 TO -.10	74.	1.70 TO 1.80	0.99.8	3.60 TO 3.70	0.99.9
-2.00 TO -1.90	0.2	-.10 TO .00	119.	1.80 TO 1.90	0.99.8	3.70 TO 3.80	0.99.9
-1.90 TO -1.80	0.2	.00 TO .10	119.	1.90 TO 2.00	0.99.8	3.80 TO 3.90	0.99.9
-1.80 TO -1.70	0.2	.10 TO .20	38.	2.00 TO 2.10	0.99.8	3.90 TO 4.00	0.99.9
-1.70 TO -1.60	0.2	.20 TO .30	67.	2.10 TO 2.20	0.99.8	4.00 TO 4.10	0.99.9
-1.60 TO -1.50	1.4	.30 TO .40	41.	2.20 TO 2.30	0.99.8	4.10 TO 4.20	0.99.9
-1.50 TO -1.40	0.4	.40 TO .50	28.	2.30 TO 2.40	0.99.8	4.20 TO 4.30	0.99.9
-1.40 TO -1.30	0.4	.50 TO .60	12.	2.40 TO 2.50	1.99.9	4.30 TO 4.40	0.99.9
-1.30 TO -1.20	0.4	.60 TO .70	8.	2.50 TO 2.60	0.99.9	4.40 TO 4.50	0.99.9
-1.20 TO -1.10	0.4	.70 TO .80	9.	2.60 TO 2.70	0.99.9	4.50 TO 4.60	0.99.9

# STANDARD DEVIATIONS

INTERVAL	FRQO CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FRFO CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.0	-1.10 TO -1.00	0.0	.80 TO .90	42.	2.70 TO 2.80	0.98.3
-2.90 TO -2.80	0.0	-1.00 TO -.90	0.0	.90 TO 1.00	27.	2.80 TO 2.90	0.98.3
-2.80 TO -2.70	0.0	-.90 TO -.80	0.0	1.00 TO 1.10	18.	2.90 TO 3.00	0.98.3
-2.70 TO -2.60	0.0	-.80 TO -.70	0.0	1.10 TO 1.20	15.	3.00 TO 3.10	0.98.7
-2.60 TO -2.50	0.0	-.70 TO -.60	0.0	1.20 TO 1.30	13.	3.10 TO 3.20	1.98.8
-2.50 TO -2.40	0.0	-.60 TO -.50	0.0	1.30 TO 1.40	8.	3.20 TO 3.30	1.98.9
-2.40 TO -2.30	0.0	-.50 TO -.40	0.0	1.40 TO 1.50	4.	3.30 TO 3.40	1.99.0
-2.30 TO -2.20	0.0	-.40 TO -.30	0.0	1.50 TO 1.60	2.	3.40 TO 3.50	1.99.2
-2.20 TO -2.10	0.0	-.30 TO -.20	0.0	1.60 TO 1.70	13.	3.50 TO 3.60	0.99.2
-2.10 TO -2.00	0.0	-.20 TO -.10	0.0	1.70 TO 1.80	13.	3.60 TO 3.70	0.99.2
-2.00 TO -1.90	0.0	-.10 TO .00	0.0	1.80 TO 1.90	1.	3.70 TO 3.80	0.99.2
-1.90 TO -1.80	0.0	.00 TO .10	49.	1.90 TO 2.00	2.	3.80 TO 3.90	0.99.2
-1.80 TO -1.70	0.0	.10 TO .20	105.	2.00 TO 2.10	2.	3.90 TO 4.00	0.99.2
-1.70 TO -1.60	0.0	.20 TO .30	117.	2.10 TO 2.20	4.	4.00 TO 4.10	0.99.2
-1.60 TO -1.50	0.0	.30 TO .40	109.	2.20 TO 2.30	1.	4.10 TO 4.20	1.99.3
-1.50 TO -1.40	0.0	.40 TO .50	108.	2.30 TO 2.40	3.	4.20 TO 4.30	0.99.3
-1.40 TO -1.30	0.0	.50 TO .60	73.	2.40 TO 2.50	0.	4.30 TO 4.40	1.99.4
-1.30 TO -1.20	0.0	.60 TO .70	50.	2.50 TO 2.60	2.	4.40 TO 4.50	1.99.5
-1.20 TO -1.10	0.0	.70 TO .80	44.	2.60 TO 2.70	1.	4.50 TO 4.60	1.99.5

NUMBER OF TIMES IN 1000 IN WHICH

A. THERE WAS NO OVERLAP----- 48

B. ITERATIVE PROCESS FAILED- 114



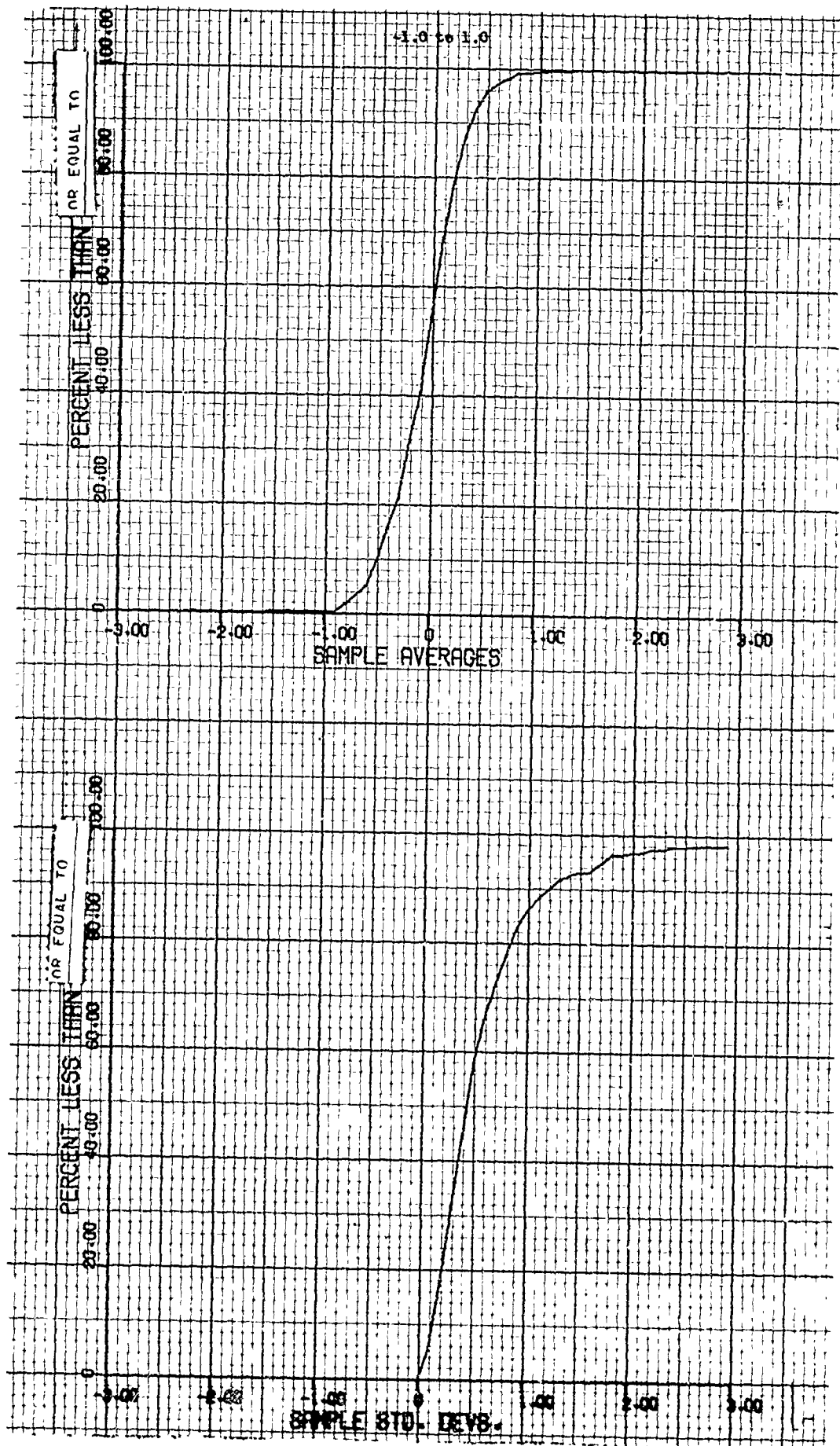


Fig 2-10



THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 0.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	4	5.1	-1.00 TO -1.00	2	9.4	.80 TO .90	1	99.6	2.70 TO 2.80	0	100.0
-2.90 TO -2.80	0	5.1	-1.00 TO -1.00	6	10.7	.90 TO 1.00	1	99.8	2.80 TO 2.90	0	100.0
-2.80 TO -2.70	1	5.3	-.90 TO -.80	5	11.7	1.00 TO 1.10	0	99.8	2.90 TO 3.00	0	100.0
-2.70 TO -2.60	1	5.5	-.80 TO -.70	1	11.9	1.10 TO 1.20	1	100.0	3.00 TO 3.10	0	100.0
-2.60 TO -2.50	1	5.7	-.70 TO -.60	2	12.3	1.20 TO 1.30	0	100.0	3.10 TO 3.20	0	100.0
-2.50 TO -2.40	6	7.0	-.60 TO -.50	6	13.5	1.30 TO 1.40	0	100.0	3.20 TO 3.30	0	100.0
-2.40 TO -2.30	3	7.6	-.50 TO -.40	0	13.5	1.40 TO 1.50	0	100.0	3.30 TO 3.40	0	100.0
-2.30 TO -2.20	0	7.6	-.40 TO -.30	29	19.5	1.50 TO 1.60	0	100.0	3.40 TO 3.50	0	100.0
-2.20 TO -2.10	1	7.8	-.30 TO -.20	13	22.1	1.60 TO 1.70	0	100.0	3.50 TO 3.60	0	100.0
-2.10 TO -2.00	1	8.0	-.20 TO -.10	30	28.3	1.70 TO 1.80	0	100.0	3.60 TO 3.70	0	100.0
-2.00 TO -1.90	0	8.0	-.10 TO .00	44	37.3	1.80 TO 1.90	0	100.0	3.70 TO 3.80	0	100.0
-1.90 TO -1.80	0	8.0	.00 TO .10	96	57.0	1.90 TO 2.00	0	100.0	3.80 TO 3.90	0	100.0
-1.80 TO -1.70	0	8.0	.10 TO .20	46	66.4	2.00 TO 2.10	0	100.0	3.90 TO 4.00	0	100.0
-1.70 TO -1.60	2	8.4	.20 TO .30	77	82.2	2.10 TO 2.20	0	100.0	4.00 TO 4.10	0	100.0
-1.60 TO -1.50	2	8.8	.30 TO .40	51	92.6	2.20 TO 2.30	0	100.0	4.10 TO 4.20	0	100.0
-1.50 TO -1.40	0	8.8	.40 TO .50	20	96.7	2.30 TO 2.40	0	100.0	4.20 TO 4.30	0	100.0
-1.40 TO -1.30	0	8.8	.50 TO .60	8	98.4	2.40 TO 2.50	0	100.0	4.30 TO 4.40	0	100.0
-1.30 TO -1.20	0	8.8	.60 TO .70	3	99.4	2.50 TO 2.60	0	100.0	4.40 TO 4.50	0	100.0
-1.20 TO -1.10	1	9.0	.70 TO .80	2	99.4	2.60 TO 2.70	0	100.0	4.50 TO 4.60	0	100.0

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	.80 TO .90	30	70.9	2.70 TO 2.80	0	90.6
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	.90 TO 1.00	24	75.8	2.80 TO 2.90	0	90.6
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	1.00 TO 1.10	11	78.1	2.90 TO 3.00	0	90.6
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	1.10 TO 1.20	6	79.3	3.00 TO 3.10	0	90.6
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	1.20 TO 1.30	9	81.1	3.10 TO 3.20	0	90.6
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	1.30 TO 1.40	6	82.4	3.20 TO 3.30	0	90.6
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	1.40 TO 1.50	8	84.0	3.30 TO 3.40	1	90.8
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	1.50 TO 1.60	9	85.9	3.40 TO 3.50	2	91.2
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	1.60 TO 1.70	3	86.5	3.50 TO 3.60	0	91.2
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	1.70 TO 1.80	1	86.7	3.60 TO 3.70	1	91.4
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	1.80 TO 1.90	7	88.1	3.70 TO 3.80	1	91.6
-1.90 TO -1.80	0	0.0	.00 TO .10	34	7.0	1.90 TO 2.00	5	89.1	3.80 TO 3.90	2	92.0
-1.80 TO -1.70	0	0.0	.10 TO .20	42	15.6	2.00 TO 2.10	0	89.1	3.90 TO 4.00	0	92.0
-1.70 TO -1.60	0	0.0	.20 TO .30	44	24.6	2.10 TO 2.20	4	90.0	4.00 TO 4.10	4	92.8
-1.60 TO -1.50	0	0.0	.30 TO .40	68	38.5	2.20 TO 2.30	2	90.4	4.10 TO 4.20	3	93.4
-1.50 TO -1.40	0	0.0	.40 TO .50	56	50.0	2.30 TO 2.40	1	90.6	4.20 TO 4.30	5	94.5
-1.40 TO -1.30	0	0.0	.50 TO .60	25	55.1	2.40 TO 2.50	0	90.6	4.30 TO 4.40	1	94.7
-1.30 TO -1.20	0	0.0	.60 TO .70	22	59.6	2.50 TO 2.60	0	90.6	4.40 TO 4.50	0	94.7
-1.20 TO -1.10	0	0.0	.70 TO .80	25	64.8	2.60 TO 2.70	0	90.6	4.50 TO 4.60	1	94.9

NUMER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 6A
- B. ITERATIVE PROCESS FAILED- 444

Fig 2-11

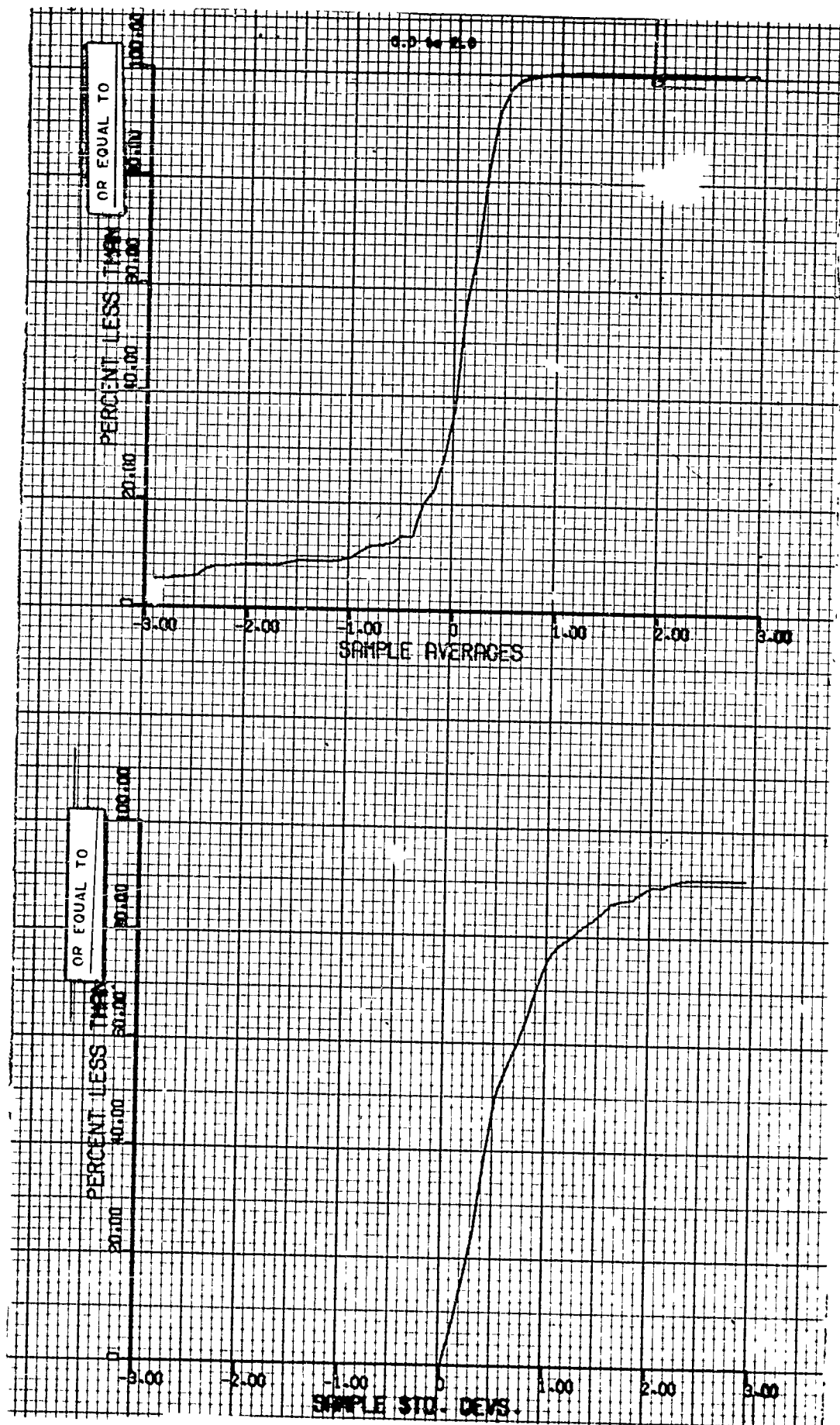


Fig 2-12

THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -1.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	.1	-1.10 TO -1.00	2.	.8	.80 TO .90	3.	99.6	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	1.	.2	-1.00 TO -.90	2.	1.1	.90 TO 1.00	1.	99.8	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	1.	.4	-.90 TO -.80	7.	1.9	1.00 TO 1.10	1.	99.9	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	.4	-.80 TO -.70	13.	3.4	1.10 TO 1.20	0.	99.9	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	.4	-.70 TO -.60	26.	6.5	1.20 TO 1.30	0.	99.9	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	.4	-.60 TO -.50	19.	8.7	1.30 TO 1.40	0.	99.9	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	1.	.5	-.50 TO -.40	42.	13.6	1.40 TO 1.50	0.	99.9	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	.5	-.40 TO -.30	57.	20.4	1.50 TO 1.60	1.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	.5	-.30 TO -.20	83.	30.1	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	.5	-.20 TO -.10	83.	39.9	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	.5	-.10 TO .00	86.	50.0	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	.5	.00 TO .10	103.	62.1	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	.5	.10 TO .20	93.	73.1	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	.5	.20 TO .30	70.	81.3	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	.5	.30 TO .40	79.	90.6	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	.5	.40 TO .50	40.	95.3	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	.5	.50 TO .60	19.	97.5	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	.5	.60 TO .70	10.	98.7	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	1.	.6	.70 TO .80	5.	99.3	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	26.	79.9	2.70 TO 2.80	3.	98.8
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	38.	84.4	2.80 TO 2.90	0.	98.8
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	22.	86.9	2.90 TO 3.00	0.	98.8
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	17.	88.9	3.00 TO 3.10	1.	98.9
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	27.	92.1	3.10 TO 3.20	0.	98.9
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	8.	93.1	3.20 TO 3.30	1.	99.1
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	10.	94.2	3.30 TO 3.40	1.	99.2
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	6.	94.9	3.40 TO 3.50	0.	99.2
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	2.	95.2	3.50 TO 3.60	1.	99.3
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	4.	95.6	3.60 TO 3.70	0.	99.3
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	3.	96.0	3.70 TO 3.80	0.	99.3
-1.90 TO -1.80	0.	0.0	.00 TO .10	33.	3.9	1.90 TO 2.00	4.	96.5	3.80 TO 3.90	0.	99.3
-1.80 TO -1.70	0.	0.0	.10 TO .20	93.	14.8	2.00 TO 2.10	8.	97.4	3.90 TO 4.00	0.	99.3
-1.70 TO -1.60	0.	0.0	.20 TO .30	98.	26.4	2.10 TO 2.20	4.	97.9	4.00 TO 4.10	0.	99.3
-1.60 TO -1.50	0.	0.0	.30 TO .40	106.	38.8	2.20 TO 2.30	3.	98.2	4.10 TO 4.20	0.	99.3
-1.50 TO -1.40	0.	0.0	.40 TO .50	105.	51.2	2.30 TO 2.40	1.	98.2	4.20 TO 4.30	0.	99.3
-1.40 TO -1.30	0.	0.0	.50 TO .60	85.	61.2	2.40 TO 2.50	1.	98.4	4.30 TO 4.40	0.	99.3
-1.30 TO -1.20	0.	0.0	.60 TO .70	89.	71.6	2.50 TO 2.60	1.	98.5	4.40 TO 4.50	0.	99.3
-1.20 TO -1.10	0.	0.0	.70 TO .80	44.	76.8	2.60 TO 2.70	0.	98.5	4.50 TO 4.60	0.	99.3

NUMBER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 51
- B. ITERATIVE PROCESS FAILED----- 97

192-13

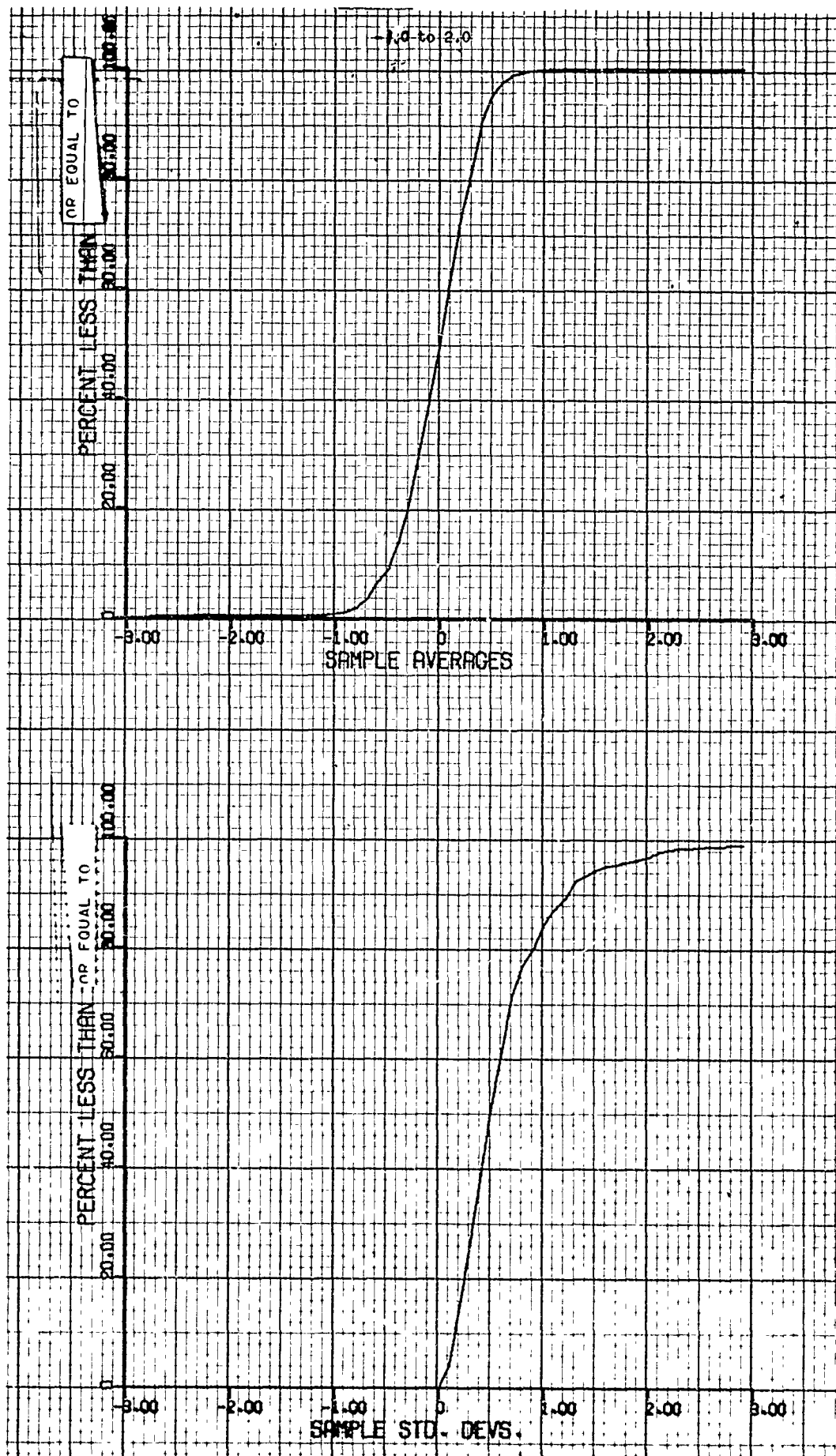


Fig 2-14

THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -2.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	4.	.9	.80 TO .90	5.	98.9	2.70 TO 2.80	1.	100.0
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	7.	1.7	.90 TO 1.00	3.	99.2	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	12.	3.0	1.00 TO 1.10	2.	99.4	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	13.	4.5	1.10 TO 1.20	2.	99.7	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	20.	6.8	1.20 TO 1.30	1.	99.8	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	23.	9.4	1.30 TO 1.40	0.	99.8	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	62.	16.4	1.40 TO 1.50	1.	99.9	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	61.	23.3	1.50 TO 1.60	0.	99.9	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	86.	33.0	1.60 TO 1.70	0.	99.9	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	69.	40.7	1.70 TO 1.80	0.	99.9	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	96.	51.6	1.80 TO 1.90	0.	99.9	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	95.	62.3	1.90 TO 2.00	0.	99.9	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	98.	73.4	2.00 TO 2.10	0.	99.9	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	73.	81.6	2.10 TO 2.20	0.	99.9	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	58.	88.1	2.20 TO 2.30	0.	99.9	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	50.	93.8	2.30 TO 2.40	0.	99.9	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.0	.50 TO .60	17.	95.7	2.40 TO 2.50	0.	99.9	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	2.	.2	.60 TO .70	17.	97.6	2.50 TO 2.60	0.	99.9	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	2.	.5	.70 TO .80	6.	98.3	2.60 TO 2.70	0.	99.9	4.50 TO 4.60	0.	100.0

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	66.	74.8	2.70 TO 2.80	2.	99.3
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	43.	79.7	2.80 TO 2.90	0.	99.3
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	31.	83.2	2.90 TO 3.00	0.	99.3
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	24.	85.9	3.00 TO 3.10	0.	99.3
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	27.	88.9	3.10 TO 3.20	0.	99.3
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	17.	90.9	3.20 TO 3.30	0.	99.3
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	21.	93.2	3.30 TO 3.40	2.	99.5
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	5.	93.8	3.40 TO 3.50	1.	99.7
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	12.	95.1	3.50 TO 3.60	0.	99.7
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	3.	95.5	3.60 TO 3.70	0.	99.7
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	4.	95.9	3.70 TO 3.80	0.	99.7
-1.90 TO -1.80	0.	0.0	.00 TO .10	14.	1.6	1.90 TO 2.00	6.	96.6	3.80 TO 3.90	1.	99.8
-1.80 TO -1.70	0.	0.0	.10 TO .20	69.	9.4	2.00 TO 2.10	8.	97.5	3.90 TO 4.00	0.	99.8
-1.70 TO -1.60	0.	0.0	.20 TO .30	91.	19.6	2.10 TO 2.20	2.	97.7	4.00 TO 4.10	0.	99.8
-1.60 TO -1.50	0.	0.0	.30 TO .40	93.	30.1	2.20 TO 2.30	3.	98.1	4.10 TO 4.20	0.	99.8
-1.50 TO -1.40	0.	0.0	.40 TO .50	89.	40.2	2.30 TO 2.40	3.	98.4	4.20 TO 4.30	0.	99.8
-1.40 TO -1.30	0.	0.0	.50 TO .60	105.	52.0	2.40 TO 2.50	2.	98.6	4.30 TO 4.40	0.	99.8
-1.30 TO -1.20	0.	0.0	.60 TO .70	75.	60.5	2.50 TO 2.60	2.	98.9	4.40 TO 4.50	0.	99.8
-1.20 TO -1.10	0.	0.0	.70 TO .80	61.	67.4	2.60 TO 2.70	2.	99.1	4.50 TO 4.60	0.	99.8

NUMER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 65
- B. ITERATIVE PROCESS FAILED- 49

Feb 2-15

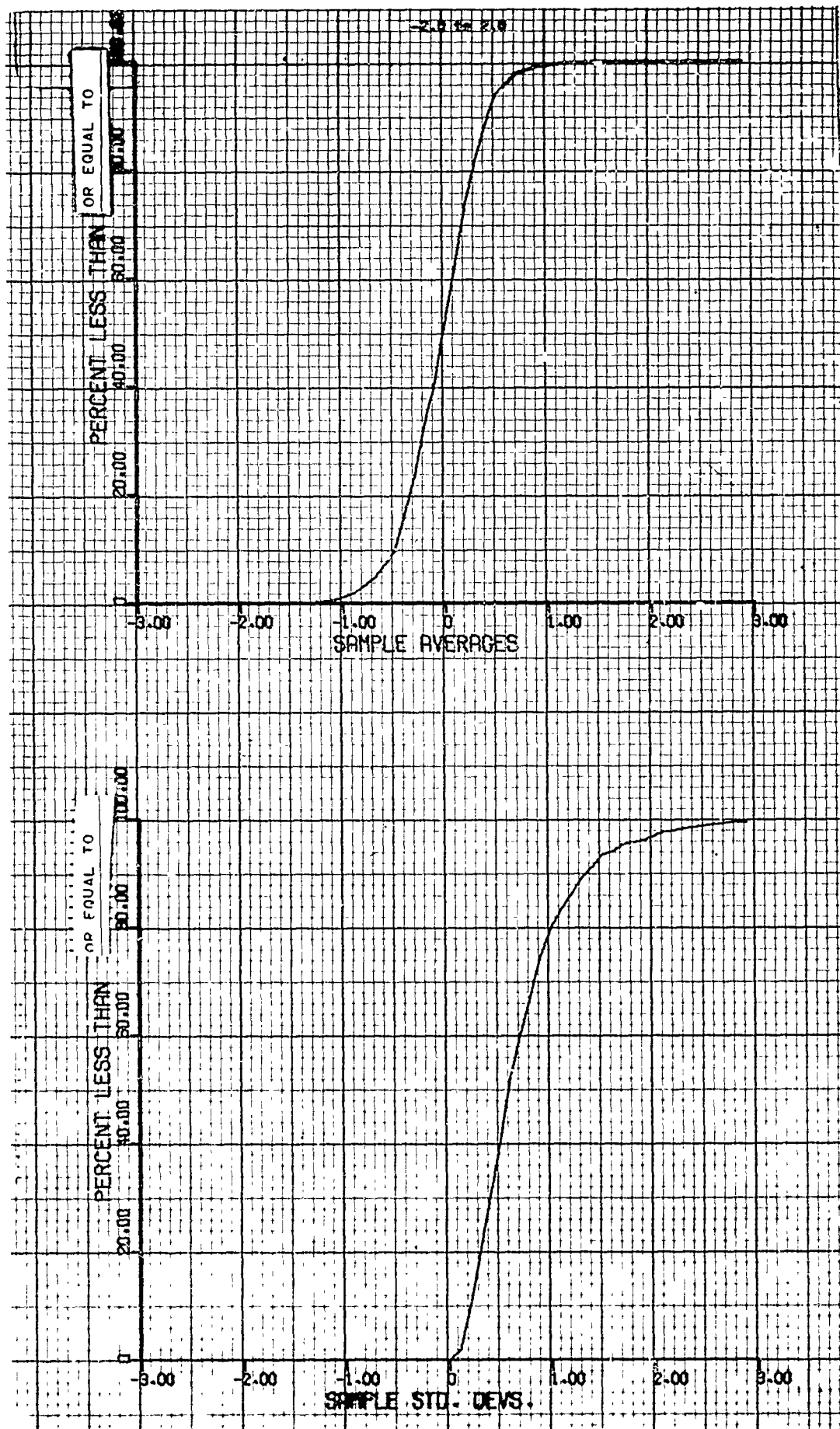


Fig 2-16

THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 100 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -0.00 AND 3.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	4.3	-1.10 TO -1.00	0.	6.2	.80 TO .90	3.	99.8	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	4.3	-1.00 TO -.90	1.	6.4	.90 TO 1.00	1.	100.0	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	4.3	-.90 TO -.80	6.	7.7	1.00 TO 1.10	0.	100.0	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	4.3	-.80 TO -.70	1.	7.9	1.10 TO 1.20	0.	100.0	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	4.3	-.70 TO -.60	1.	8.2	1.20 TO 1.30	0.	100.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	4.3	-.60 TO -.50	33.	15.2	1.30 TO 1.40	0.	100.0	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	3.	4.9	-.50 TO -.40	13.	18.0	1.40 TO 1.50	0.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	4.9	-.40 TO -.30	22.	22.7	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	4.9	-.30 TO -.20	16.	26.2	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	4.9	-.20 TO -.10	16.	29.8	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	4.9	-.10 TO .00	39.	38.0	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	4.9	.00 TO .10	85.	56.2	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	4.9	.10 TO .20	66.	70.4	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	1.	5.2	.20 TO .30	34.	77.7	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	1.	5.4	.30 TO .40	47.	87.8	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	5.4	.40 TO .50	16.	91.2	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	3.	6.0	.50 TO .60	28.	98.2	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	6.0	.60 TO .70	7.	98.7	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	1.	6.2	.70 TO .80	2.	99.1	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	31.	65.5	2.70 TO 2.80	1.	94.8
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	14.	64.5	2.80 TO 2.90	0.	94.8
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	14.	71.5	2.90 TO 3.00	1.	95.1
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	13.	74.2	3.00 TO 3.10	0.	95.1
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	6.	75.5	3.10 TO 3.20	0.	95.1
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	19.	79.6	3.20 TO 3.30	0.	95.1
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	22.	84.3	3.30 TO 3.40	0.	95.1
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	13.	87.1	3.40 TO 3.50	1.	95.3
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	1.	87.3	3.50 TO 3.60	1.	95.5
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	2.	87.8	3.60 TO 3.70	0.	95.5
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	1.	88.0	3.70 TO 3.80	0.	95.5
-1.90 TO -1.80	0.	0.0	.00 TO .10	34.	7.3	1.90 TO 2.00	5.	89.1	3.80 TO 3.90	0.	95.5
-1.80 TO -1.70	0.	0.0	.10 TO .20	44.	16.7	2.00 TO 2.10	2.	89.5	3.90 TO 4.00	0.	95.5
-1.70 TO -1.60	0.	0.0	.20 TO .30	31.	24.0	2.10 TO 2.20	3.	90.1	4.00 TO 4.10	0.	95.5
-1.60 TO -1.50	0.	0.0	.30 TO .40	29.	30.3	2.20 TO 2.30	6.	91.4	4.10 TO 4.20	0.	95.5
-1.50 TO -1.40	0.	0.0	.40 TO .50	37.	38.2	2.30 TO 2.40	6.	92.7	4.20 TO 4.30	0.	95.5
-1.40 TO -1.30	0.	0.0	.50 TO .60	55.	50.0	2.40 TO 2.50	6.	94.0	4.30 TO 4.40	0.	95.5
-1.30 TO -1.20	0.	0.0	.60 TO .70	26.	55.6	2.50 TO 2.60	3.	94.6	4.40 TO 4.50	0.	95.5
-1.20 TO -1.10	0.	0.0	.70 TO .80	15.	58.8	2.60 TO 2.70	0.	94.6	4.50 TO 4.60	0.	95.5

NUMBER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 100
- B. ITERATIVE PROCESS FAILED- 434

Fig 2-17



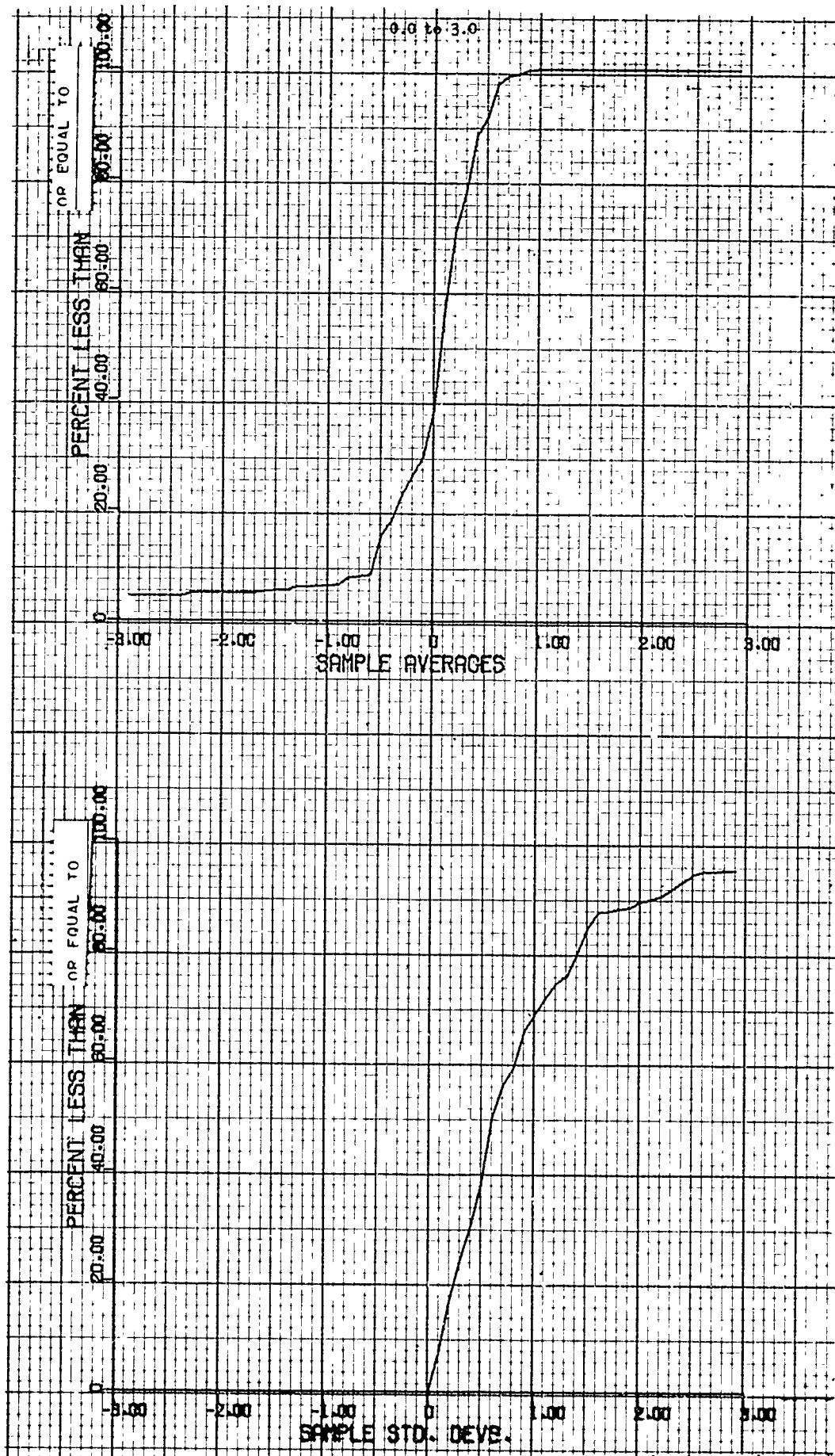


Fig 2-18



THE DATA REPRESENTED BELOW HAS A TRUE STD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGRANJE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -1.00 AND 1.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVRAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	.1	-1.10 TO -1.00	2.	1.4	.80 TO .90	5.	99.7	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	.1	-1.00 TO -.90	1.	1.5	.90 TO 1.00	1.	99.8	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	.1	-.90 TO -.80	5.	2.1	1.00 TO 1.10	0.	99.8	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	1.	.2	-.80 TO -.70	19.	4.3	1.10 TO 1.20	2.	100.0	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	.2	-.70 TO -.60	20.	6.4	1.20 TO 1.30	0.	100.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	.2	-.60 TO -.50	28.	9.9	1.30 TO 1.40	0.	100.0	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	.2	-.50 TO -.40	41.	14.6	1.40 TO 1.50	0.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	.2	-.40 TO -.30	52.	20.7	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	.2	-.30 TO -.20	84.	30.4	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	.2	-.20 TO -.10	79.	39.6	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	1.	.3	-.10 TO .00	94.	50.5	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	.3	.00 TO .10	118.	64.2	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	.3	.10 TO .20	81.	73.6	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	2.	.6	.20 TO .30	73.	82.1	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	1.	.7	.30 TO .40	48.	87.7	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	1.	.8	.40 TO .50	37.	92.8	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	.8	.50 TO .60	38.	96.4	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	1.	.9	.60 TO .70	14.	98.0	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	2.	1.2	.70 TO .80	9.	99.1	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	51.	78.4	2.70 TO 2.80	1.	98.5
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	37.	82.7	2.80 TO 2.90	1.	98.6
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	21.	85.1	2.90 TO 3.00	1.	98.7
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	21.	87.6	3.00 TO 3.10	0.	98.7
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	16.	89.4	3.10 TO 3.20	1.	98.8
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	10.	90.6	3.20 TO 3.30	0.	98.8
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	10.	91.8	3.30 TO 3.40	3.	99.2
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	15.	93.5	3.40 TO 3.50	1.	99.3
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	13.	95.0	3.50 TO 3.60	1.	99.4
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	7.	95.8	3.60 TO 3.70	2.	99.7
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	4.	96.3	3.70 TO 3.80	1.	99.8
-1.90 TO -1.80	0.	0.0	.00 TO .10	45.	5.2	1.90 TO 2.00	2.	96.5	3.80 TO 3.90	0.	99.8
-1.80 TO -1.70	0.	0.0	.10 TO .20	81.	14.6	2.00 TO 2.10	4.	97.0	3.90 TO 4.00	0.	99.8
-1.70 TO -1.60	0.	0.0	.20 TO .30	93.	25.4	2.10 TO 2.20	1.	97.1	4.00 TO 4.10	0.	99.8
-1.60 TO -1.50	0.	0.0	.30 TO .40	123.	39.7	2.20 TO 2.30	2.	97.3	4.10 TO 4.20	0.	99.8
-1.50 TO -1.40	0.	0.0	.40 TO .50	99.	51.2	2.30 TO 2.40	1.	97.4	4.20 TO 4.30	0.	99.8
-1.40 TO -1.30	0.	0.0	.50 TO .60	70.	59.3	2.40 TO 2.50	4.	97.9	4.30 TO 4.40	0.	99.8
-1.30 TO -1.20	0.	0.0	.60 TO .70	71.	67.6	2.50 TO 2.60	1.	98.0	4.40 TO 4.50	0.	99.8
-1.20 TO -1.10	0.	0.0	.70 TO .80	42.	72.5	2.60 TO 2.70	3.	98.4	4.50 TO 4.60	0.	99.8

NUMBER OF TIMES IN 1000 IN WHICH

- THERE WAS NO OVERLAP
- ITERATIVE PROCESS FAILED

Fig 2-19

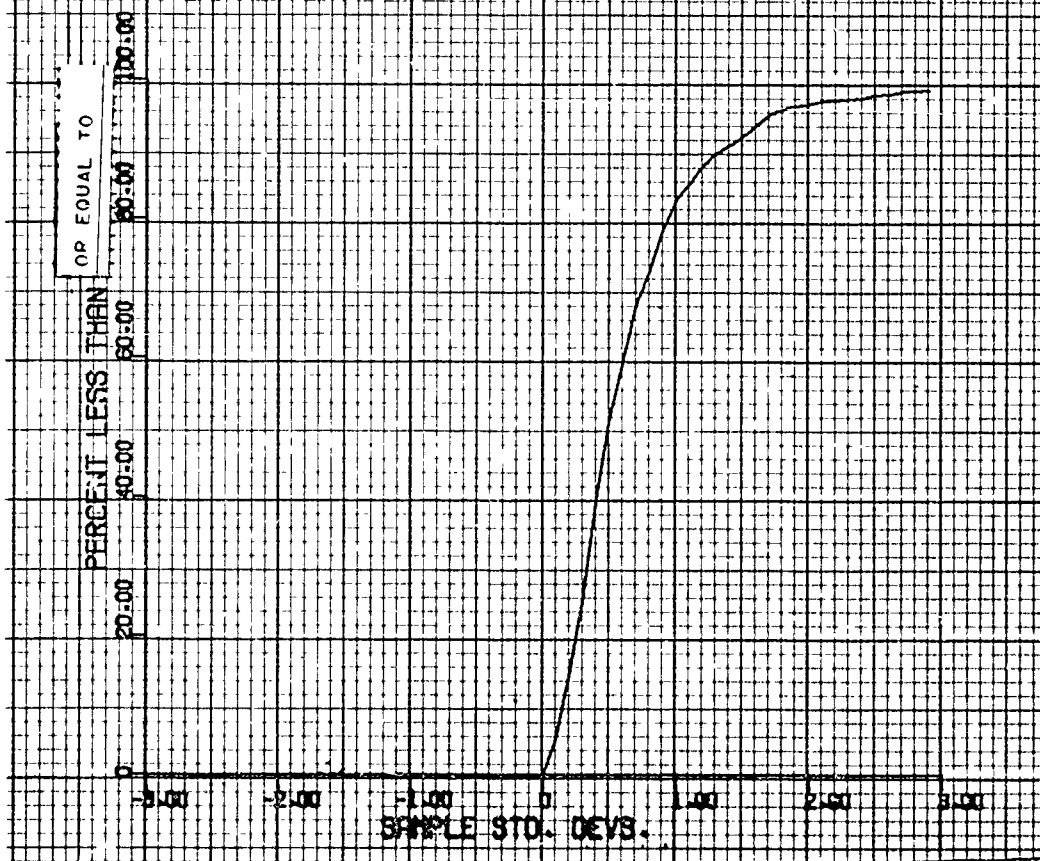
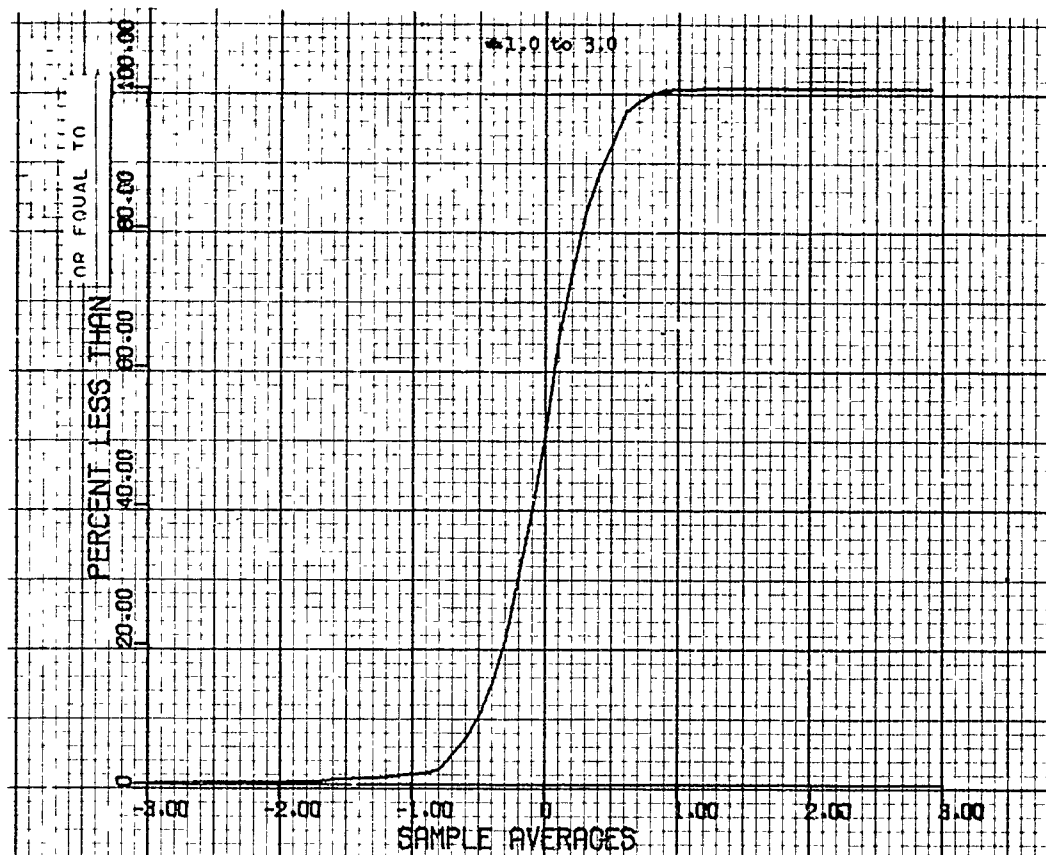


Fig 2-20

\*\*\*\*\*  
 THE DATA REPRESENTED BELOW HAS A TRUE  $\mu$  OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLIE SENSITIVITY  
 TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -2.00 AND 3.00 RESPECTIVELY.  
 THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.  
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AVERAGES

INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	1.	1.5	.80 TO .90	7.	99.4	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	9.	1.5	.90 TO 1.00	1.	99.8	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	11.	2.8	1.00 TO 1.10	0.	99.8	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	10.	4.0	1.10 TO 1.20	0.	99.8	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	26.	7.1	1.20 TO 1.30	0.	99.8	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	33.	11.1	1.30 TO 1.40	1.	99.9	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	36.	15.5	1.40 TO 1.50	1.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	61.	22.9	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	70.	31.3	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	71.	39.9	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	81.	49.7	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	79.	59.3	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	91.	70.3	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	70.	78.7	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	70.	87.2	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	38.	91.8	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	1.	1.	.50 TO .60	27.	95.0	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	1.	.60 TO .70	22.	97.7	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	1.	2.	.70 TO .80	7.	98.5	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

STANDARD DEVIATIONS

INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	56.	75.6	2.70 TO 2.80	0.	99.3
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	44.	80.9	2.80 TO 2.90	0.	99.3
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	50.	86.9	2.90 TO 3.00	1.	99.4
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	14.	88.6	3.00 TO 3.10	0.	99.4
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	19.	90.9	3.10 TO 3.20	0.	99.4
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	14.	93.1	3.20 TO 3.30	1.	99.5
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	9.	94.2	3.30 TO 3.40	0.	99.5
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	5.	94.8	3.40 TO 3.50	0.	99.5
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	12.	96.3	3.50 TO 3.60	0.	99.5
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	5.	96.9	3.60 TO 3.70	0.	99.5
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	5.	97.5	3.70 TO 3.80	0.	99.5
-1.90 TO -1.80	0.	0.0	.00 TO .10	23.	2.8	1.90 TO 2.00	3.	97.8	3.80 TO 3.90	0.	99.5
-1.80 TO -1.70	0.	0.0	.10 TO .20	55.	9.4	2.00 TO 2.10	2.	98.1	3.90 TO 4.00	0.	99.5
-1.70 TO -1.60	0.	0.0	.20 TO .30	69.	17.8	2.10 TO 2.20	7.	98.9	4.00 TO 4.10	0.	99.5
-1.60 TO -1.50	0.	0.0	.30 TO .40	72.	26.5	2.20 TO 2.30	0.	98.9	4.10 TO 4.20	1.	99.6
-1.50 TO -1.40	0.	0.0	.40 TO .50	105.	39.2	2.30 TO 2.40	0.	98.9	4.20 TO 4.30	0.	99.6
-1.40 TO -1.30	0.	0.0	.50 TO .60	65.	47.0	2.40 TO 2.50	1.	99.0	4.30 TO 4.40	0.	99.6
-1.30 TO -1.20	0.	0.0	.60 TO .70	100.	59.1	2.50 TO 2.60	0.	99.0	4.40 TO 4.50	1.	99.8
-1.20 TO -1.10	0.	0.0	.70 TO .80	80.	68.8	2.60 TO 2.70	2.	99.3	4.50 TO 4.60	0.	99.8

NUMBER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 95
- B. ITERATIVE PROCESS FAILED- 78

Fig. D-2

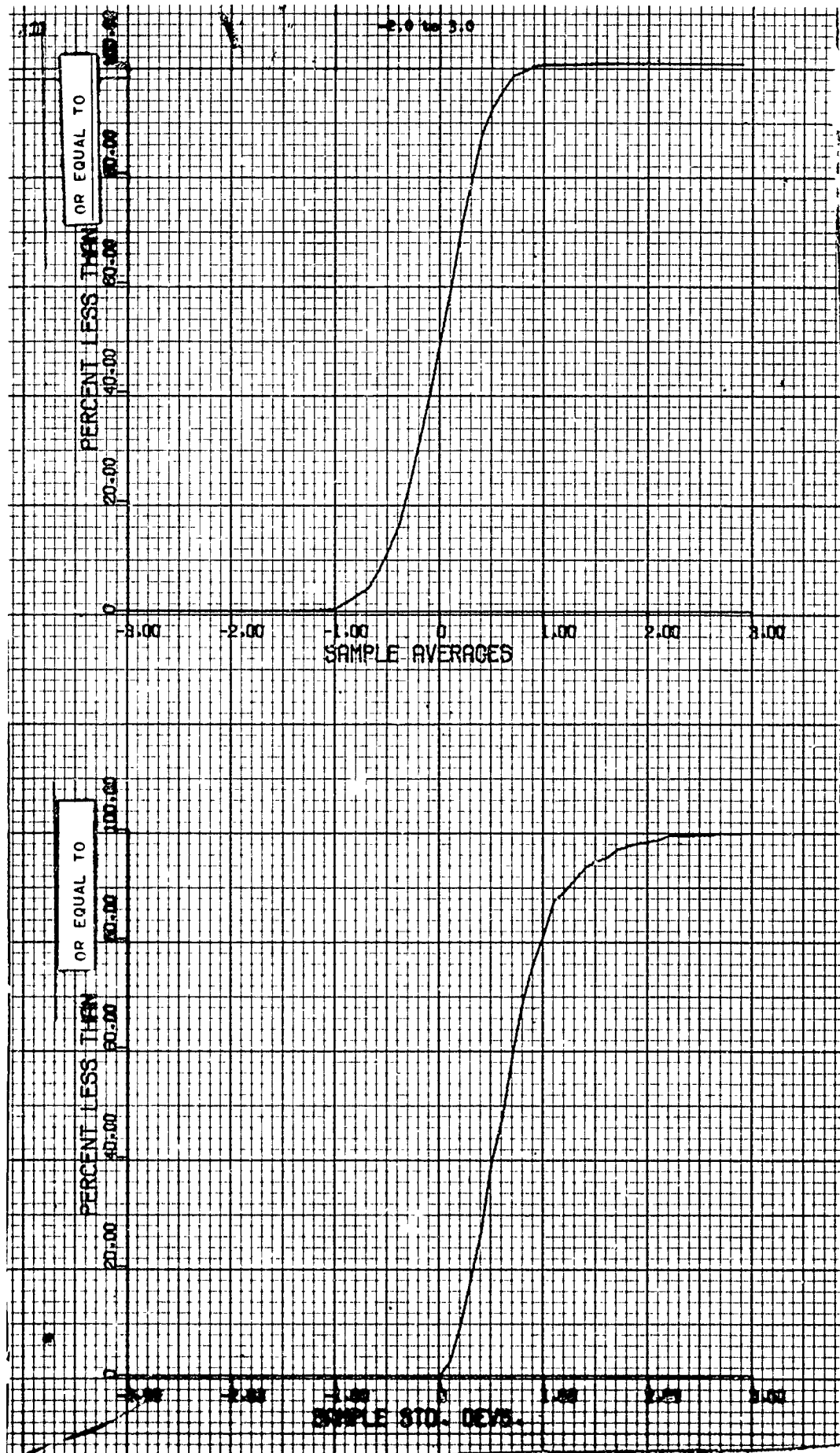


Fig 2-22

THE DATA REPRESENTED BELOW WAS A TRUE 450 OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLIFF SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -3.00 AND 3.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	2	.6	.80 TO .90	8	99.8	2.70 TO 2.80	0	100.0
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	2	.8	.90 TO 1.00	0	99.8	2.80 TO 2.90	0	100.0
-2.80 TO -2.70	0	0.0	-.90 TO -.80	8	1.7	1.00 TO 1.10	1	99.9	2.90 TO 3.00	0	100.0
-2.70 TO -2.60	0	0.0	-.80 TO -.70	23	4.3	1.10 TO 1.20	1	100.0	3.00 TO 3.10	0	100.0
-2.60 TO -2.50	0	0.0	-.70 TO -.60	24	7.0	1.20 TO 1.30	0	100.0	3.10 TO 3.20	0	100.0
-2.50 TO -2.40	0	0.0	-.60 TO -.50	28	10.2	1.30 TO 1.40	0	100.0	3.20 TO 3.30	0	100.0
-2.40 TO -2.30	0	0.0	-.50 TO -.40	46	15.3	1.40 TO 1.50	0	100.0	3.30 TO 3.40	0	100.0
-2.30 TO -2.20	0	0.0	-.40 TO -.30	61	22.2	1.50 TO 1.60	0	100.0	3.40 TO 3.50	0	100.0
-2.20 TO -2.10	0	0.0	-.30 TO -.20	86	31.9	1.60 TO 1.70	0	100.0	3.50 TO 3.60	0	100.0
-2.10 TO -2.00	0	0.0	-.20 TO -.10	74	40.3	1.70 TO 1.80	0	100.0	3.60 TO 3.70	0	100.0
-2.00 TO -1.90	0	0.0	-.10 TO .00	85	49.9	1.80 TO 1.90	0	100.0	3.70 TO 3.80	0	100.0
-1.90 TO -1.80	0	0.0	.00 TO .10	95	60.6	1.90 TO 2.00	0	100.0	3.80 TO 3.90	0	100.0
-1.80 TO -1.70	0	0.0	.10 TO .20	86	70.3	2.00 TO 2.10	0	100.0	3.90 TO 4.00	0	100.0
-1.70 TO -1.60	0	0.0	.20 TO .30	96	81.2	2.10 TO 2.20	0	100.0	4.00 TO 4.10	0	100.0
-1.60 TO -1.50	0	0.0	.30 TO .40	60	87.9	2.20 TO 2.30	0	100.0	4.10 TO 4.20	0	100.0
-1.50 TO -1.40	0	0.0	.40 TO .50	33	91.6	2.30 TO 2.40	0	100.0	4.20 TO 4.30	0	100.0
-1.40 TO -1.30	0	0.0	.50 TO .60	29	94.9	2.40 TO 2.50	0	100.0	4.30 TO 4.40	0	100.0
-1.30 TO -1.20	2	.2	.60 TO .70	23	97.5	2.50 TO 2.60	0	100.0	4.40 TO 4.50	0	100.0
-1.20 TO -1.10	1	.3	.70 TO .80	12	98.9	2.60 TO 2.70	0	100.0	4.50 TO 4.60	0	100.0

Fig 2-23

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	.80 TO .90	90	73.8	2.70 TO 2.80	0	99.8
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	.90 TO 1.00	23	76.4	2.80 TO 2.90	1	99.9
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	1.00 TO 1.10	40	80.9	2.90 TO 3.00	0	99.9
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	1.10 TO 1.20	40	85.4	3.00 TO 3.10	0	99.9
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	1.20 TO 1.30	41	90.1	3.10 TO 3.20	0	99.9
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	1.30 TO 1.40	23	92.7	3.20 TO 3.30	0	99.9
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	1.40 TO 1.50	19	94.8	3.30 TO 3.40	0	99.9
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	1.50 TO 1.60	15	96.5	3.40 TO 3.50	1	100.0
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	1.60 TO 1.70	9	97.5	3.50 TO 3.60	0	100.0
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	1.70 TO 1.80	5	98.1	3.60 TO 3.70	0	100.0
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	1.80 TO 1.90	5	98.6	3.70 TO 3.80	0	100.0
-1.90 TO -1.80	0	0.0	.00 TO .10	9	1.0	1.90 TO 2.00	2	98.9	3.80 TO 3.90	0	100.0
-1.80 TO -1.70	0	0.0	.10 TO .20	51	6.8	2.00 TO 2.10	2	99.1	3.90 TO 4.00	0	100.0
-1.70 TO -1.60	0	0.0	.20 TO .30	75	15.2	2.10 TO 2.20	3	99.4	4.00 TO 4.10	0	100.0
-1.60 TO -1.50	0	0.0	.30 TO .40	93	25.7	2.20 TO 2.30	1	99.5	4.10 TO 4.20	0	100.0
-1.50 TO -1.40	0	0.0	.40 TO .50	96	36.6	2.30 TO 2.40	0	99.5	4.20 TO 4.30	0	100.0
-1.40 TO -1.30	0	0.0	.50 TO .60	117	49.8	2.40 TO 2.50	1	99.5	4.30 TO 4.40	0	100.0
-1.30 TO -1.20	0	0.0	.60 TO .70	58	56.3	2.50 TO 2.60	1	99.8	4.40 TO 4.50	0	100.0
-1.20 TO -1.10	0	0.0	.70 TO .80	65	63.7	2.60 TO 2.70	0	99.8	4.50 TO 4.60	0	100.0

NUMBER OF TIMES IN 1000 IN WHICH  
 A. THERE WAS NO OVERLAP----- 81  
 B. ITERATIVE PROCESS FAILED- 33

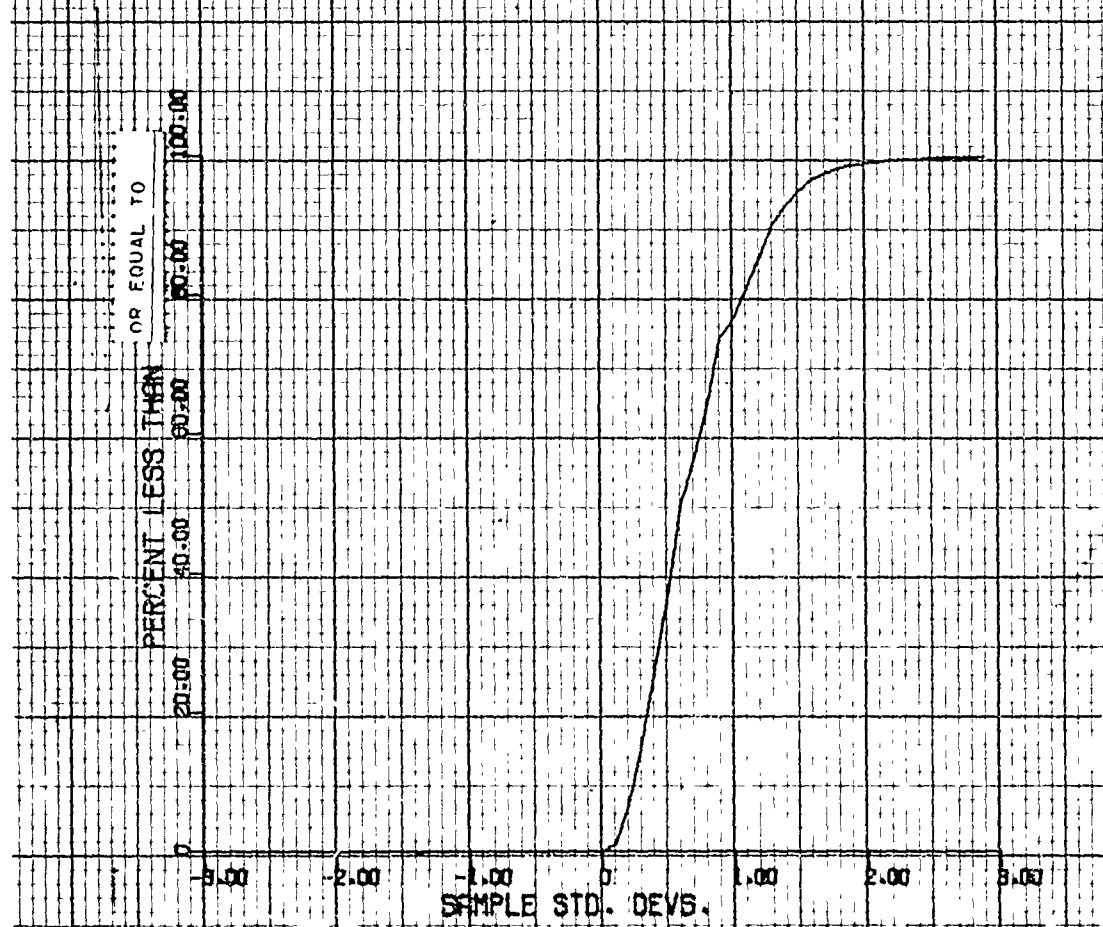
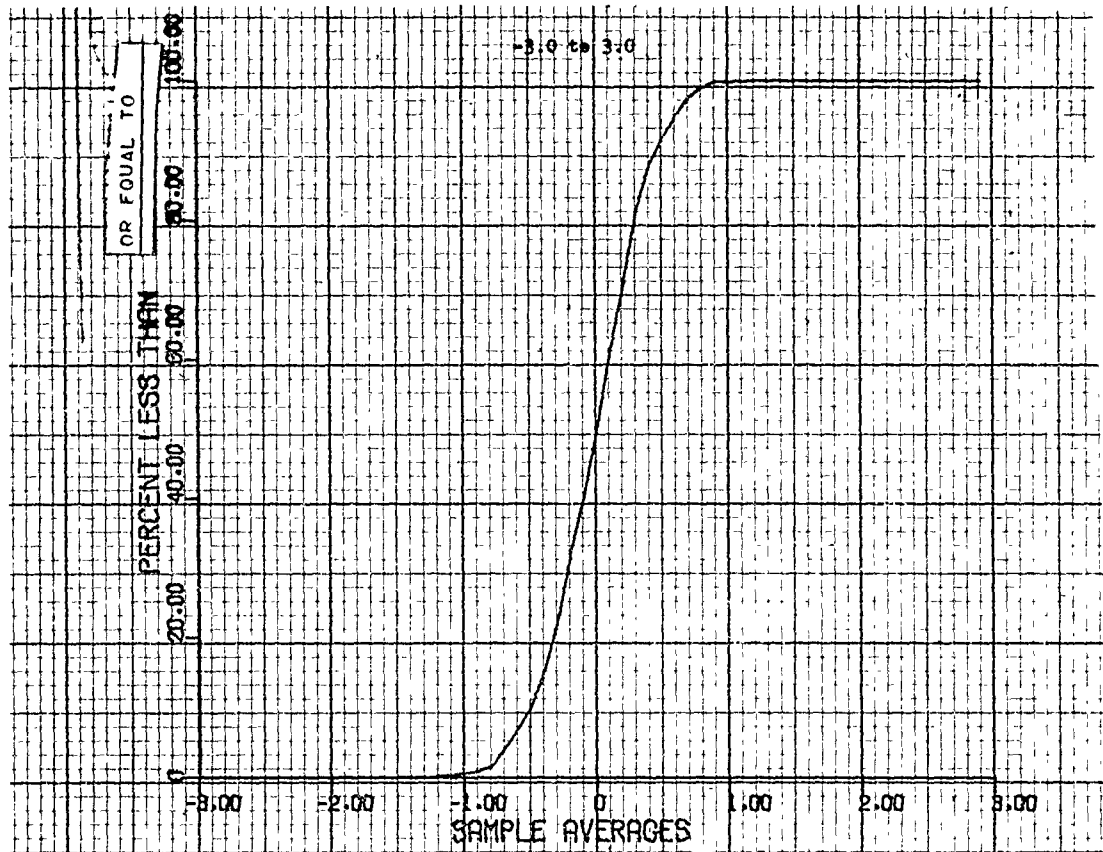


Fig 2-24

47

THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 0.00 AND 4.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	4.1	-1.10 TO -1.00	3.	8.2	.80 TO .90	2.	99.6	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	4.1	-1.00 TO -.90	1.	8.5	.90 TO 1.00	0.	99.6	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	4.1	-.90 TO -.80	0.	8.5	1.00 TO 1.10	1.	99.8	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	4.1	-.80 TO -.70	24.	13.4	1.10 TO 1.20	0.	99.8	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	4.1	-.70 TO -.60	8.	15.1	1.20 TO 1.30	1.	100.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	4.1	-.60 TO -.50	3.	15.7	1.30 TO 1.40	0.	100.0	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	4.1	-.50 TO -.40	12.	18.1	1.40 TO 1.50	0.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	4.1	-.40 TO -.30	12.	20.6	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	1.	4.3	-.30 TO -.20	8.	22.3	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	1.	4.5	-.20 TO -.10	22.	26.8	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	4.5	-.10 TO .00	49.	36.9	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	1.	4.7	.00 TO .10	69.	51.1	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	3.	5.4	.10 TO .20	89.	59.5	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	5.4	.20 TO .30	53.	80.4	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	5.4	.30 TO .40	27.	86.0	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	5.4	.40 TO .50	34.	93.0	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	5.4	.50 TO .60	18.	96.7	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	5.4	.60 TO .70	8.	98.4	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	11.	7.6	.70 TO .80	4.	99.2	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

Fig 2-25

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	11.	66.8	2.70 TO 2.80	0.	94.8
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	19.	70.7	2.80 TO 2.90	0.	94.8
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	15.	73.8	2.90 TO 3.00	0.	94.8
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	11.	76.1	3.00 TO 3.10	0.	94.8
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	14.	79.0	3.10 TO 3.20	1.	95.1
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	4.	79.8	3.20 TO 3.30	0.	95.1
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	8.	81.4	3.30 TO 3.40	2.	95.5
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	18.	85.2	3.40 TO 3.50	1.	95.7
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	4.	86.0	3.50 TO 3.60	1.	95.9
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	4.	86.8	3.60 TO 3.70	0.	95.9
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	15.	89.9	3.70 TO 3.80	0.	95.9
-1.90 TO -1.80	0.	0.0	.00 TO .10	32.	6.6	1.90 TO 2.00	7.	91.3	3.80 TO 3.90	0.	95.9
-1.80 TO -1.70	0.	0.0	.10 TO .20	57.	18.4	2.00 TO 2.10	4.	92.2	3.90 TO 4.00	1.	96.1
-1.70 TO -1.60	0.	0.0	.20 TO .30	56.	29.9	2.10 TO 2.20	2.	92.6	4.00 TO 4.10	0.	96.1
-1.60 TO -1.50	0.	0.0	.30 TO .40	52.	40.6	2.20 TO 2.30	0.	92.6	4.10 TO 4.20	0.	96.1
-1.50 TO -1.40	0.	0.0	.40 TO .50	29.	46.6	2.30 TO 2.40	3.	93.2	4.20 TO 4.30	0.	96.1
-1.40 TO -1.30	0.	0.0	.50 TO .60	22.	51.1	2.40 TO 2.50	4.	94.0	4.30 TO 4.40	0.	96.1
-1.30 TO -1.20	0.	0.0	.60 TO .70	37.	58.8	2.50 TO 2.60	3.	94.6	4.40 TO 4.50	0.	96.1
-1.20 TO -1.10	0.	0.0	.70 TO .80	28.	64.5	2.60 TO 2.70	1.	94.8	4.50 TO 4.60	0.	96.1

NUMBER OF TIMES IN 1000 IN WHICH

- THERE WAS NO OVERLAP--- 94
- ITERATIVE PROCESS FAILED- 421

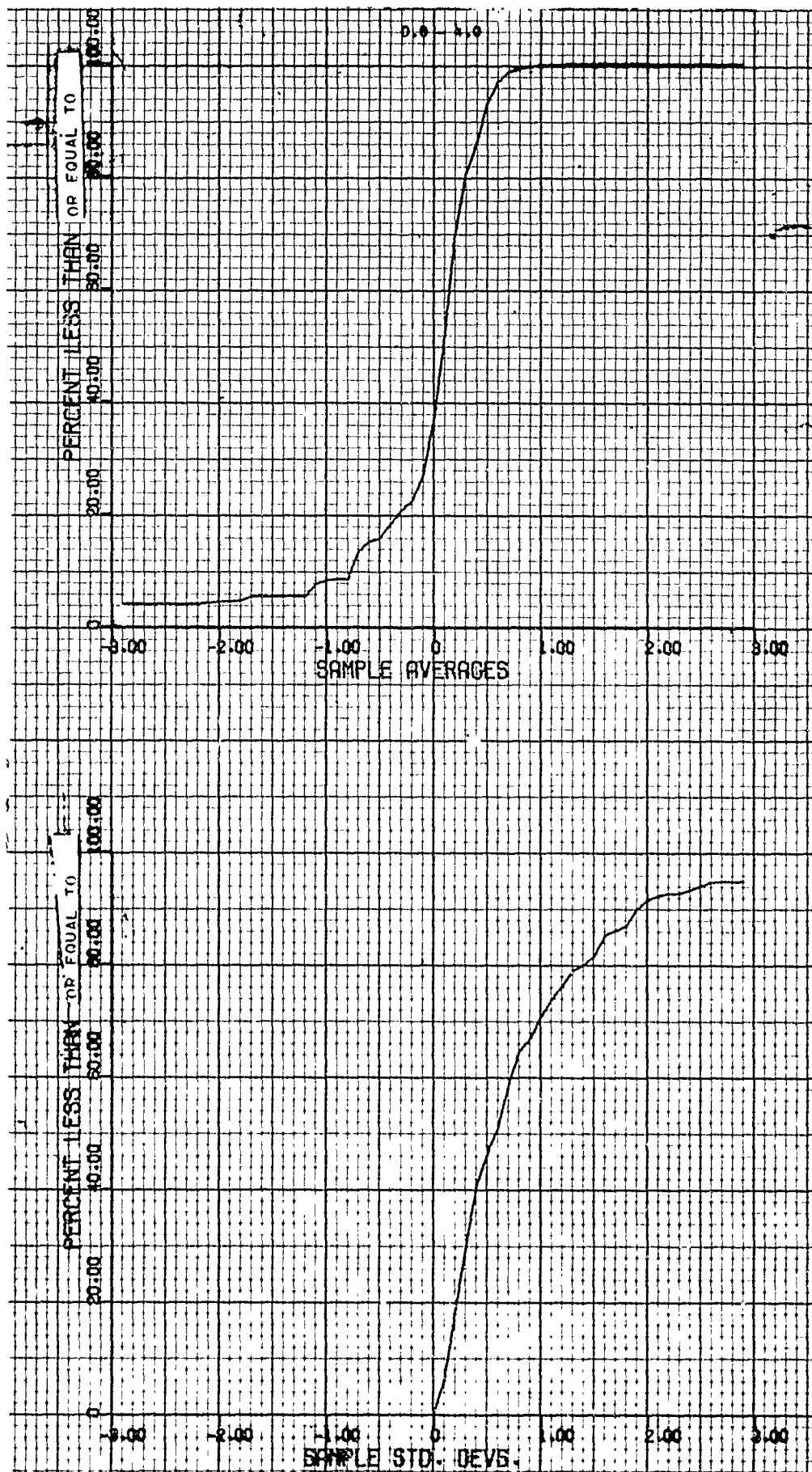


Fig 2-26



THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -1.00 AND 4.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.	-1.10 TO -1.00	2.	.6	.80 TO .90	3.	90.5	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	.1	-1.00 TO -.90	5.	1.2	.90 TO 1.00	2.	99.8	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	.1	-.90 TO -.80	5.	1.8	1.00 TO 1.10	2.	100.0	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	.1	-.80 TO -.70	7.	2.5	1.10 TO 1.20	0.	100.0	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	.1	-.70 TO -.60	12.	4.0	1.20 TO 1.30	0.	100.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	1.	.2	-.60 TO -.50	32.	7.7	1.30 TO 1.40	0.	100.0	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	.2	-.50 TO -.40	48.	13.3	1.40 TO 1.50	0.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	.2	-.40 TO -.30	80.	22.7	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	.2	-.30 TO -.20	73.	31.3	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	.2	-.20 TO -.10	84.	41.1	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	.2	-.10 TO .00	101.	52.9	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	.2	.00 TO .10	107.	65.5	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	.2	.10 TO .20	78.	74.6	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	.2	.20 TO .30	64.	82.1	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	.2	.30 TO .40	46.	87.5	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	.2	.40 TO .50	42.	92.4	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	.2	.50 TO .60	31.	96.0	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	.2	.60 TO .70	14.	97.7	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	1.	.4	.70 TO .80	13.	99.2	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

Fig 2-27

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	53.	78.7	2.70 TO 2.80	0.	99.1
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	41.	83.5	2.80 TO 2.90	0.	99.1
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	33.	87.4	2.90 TO 3.00	0.	99.1
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	16.	89.2	3.00 TO 3.10	1.	99.2
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	17.	91.2	3.10 TO 3.20	1.	99.3
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	14.	92.9	3.20 TO 3.30	0.	99.3
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	5.	93.4	3.30 TO 3.40	1.	99.4
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	5.	94.0	3.40 TO 3.50	2.	99.6
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	7.	94.8	3.50 TO 3.60	1.	99.7
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	5.	95.4	3.60 TO 3.70	0.	99.7
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	8.	96.4	3.70 TO 3.80	0.	99.8
-1.90 TO -1.80	0.	0.0	.00 TO .10	35.	4.1	1.90 TO 2.00	8.	97.3	3.80 TO 3.90	0.	99.8
-1.80 TO -1.70	0.	0.0	.10 TO .20	69.	12.2	2.00 TO 2.10	3.	97.7	3.90 TO 4.00	0.	99.8
-1.70 TO -1.60	0.	0.0	.20 TO .30	133.	27.8	2.10 TO 2.20	3.	98.0	4.00 TO 4.10	0.	99.8
-1.60 TO -1.50	0.	0.0	.30 TO .40	87.	37.9	2.20 TO 2.30	3.	98.4	4.10 TO 4.20	0.	99.8
-1.50 TO -1.40	0.	0.0	.40 TO .50	92.	48.7	2.30 TO 2.40	1.	98.7	4.20 TO 4.30	0.	99.8
-1.40 TO -1.30	0.	0.0	.50 TO .60	91.	59.4	2.40 TO 2.50	1.	98.8	4.30 TO 4.40	0.	99.8
-1.30 TO -1.20	0.	0.0	.60 TO .70	61.	67.2	2.50 TO 2.60	2.	99.1	4.40 TO 4.50	0.	99.8
-1.20 TO -1.10	0.	0.0	.70 TO .80	45.	72.5	2.60 TO 2.70	0.	99.1	4.50 TO 4.60	0.	99.8

NUMBER OF TIMES IN 1000 IN WHICH

A. THERE WAS NO OVERLAP----- 76  
B. ITERATIVE PROCESS FAILED----- 70

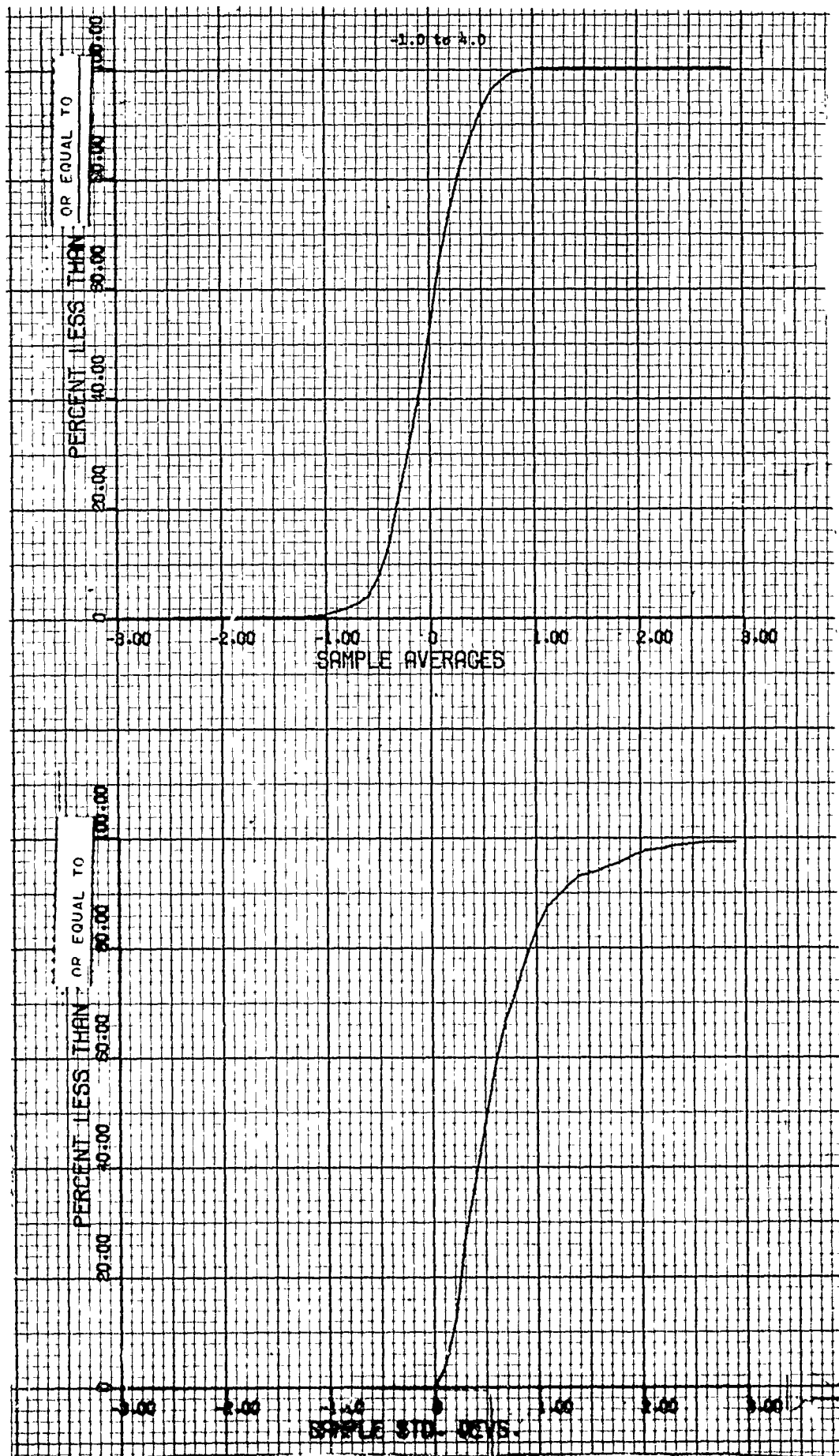


Fig 2-28

THE DATA REPRESENTED BELOW HAS A TRUE V50 OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -2.00 AND 4.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	2.	.6	.80 TO .90	7.	99.2	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	4.	1.1	.90 TO 1.00	5.	99.8	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	11.	2.4	1.00 TO 1.10	1.	99.9	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	21.	4.9	1.10 TO 1.20	1.	100.0	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	28.	8.7	1.20 TO 1.30	0.	100.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	51.	14.4	1.30 TO 1.40	0.	100.0	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	69.	22.7	1.40 TO 1.50	0.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	50.	28.7	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	67.	36.7	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	87.	47.2	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	69.	55.5	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	79.	64.9	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	70.	73.3	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	55.	80.0	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	1.	.1	.30 TO .40	54.	86.4	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.	.40 TO .50	32.	90.3	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.	.50 TO .60	26.	93.4	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	0.	.60 TO .70	28.	96.8	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	2.	.4	.70 TO .80	13.	98.3	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	65.	75.6	2.70 TO 2.80	0.	99.6
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	39.	80.3	2.80 TO 2.90	1.	99.8
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	24.	83.2	2.90 TO 3.00	0.	99.8
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	22.	85.8	3.00 TO 3.10	0.	99.8
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	21.	88.4	3.10 TO 3.20	0.	99.8
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	27.	91.0	3.20 TO 3.30	0.	99.8
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	16.	92.9	3.30 TO 3.40	0.	99.8
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	14.	94.6	3.40 TO 3.50	0.	99.8
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	9.	95.7	3.50 TO 3.60	0.	99.8
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	9.	96.8	3.60 TO 3.70	1.	99.9
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	8.	97.7	3.70 TO 3.80	0.	99.9
-1.90 TO -1.80	0.	0.0	.00 TO .10	8.	1.0	1.90 TO 2.00	2.	98.2	3.80 TO 3.90	0.	99.9
-1.80 TO -1.70	0.	0.0	.10 TO .20	49.	6.8	2.00 TO 2.10	2.	98.4	3.90 TO 4.00	0.	99.9
-1.70 TO -1.60	0.	0.0	.20 TO .30	91.	17.8	2.10 TO 2.20	5.	99.0	4.00 TO 4.10	0.	99.9
-1.60 TO -1.50	0.	0.0	.30 TO .40	66.	25.7	2.20 TO 2.30	0.	99.0	4.10 TO 4.20	0.	99.9
-1.50 TO -1.40	0.	0.0	.40 TO .50	96.	37.2	2.30 TO 2.40	2.	99.3	4.20 TO 4.30	0.	99.9
-1.40 TO -1.30	0.	0.0	.50 TO .60	97.	48.9	2.40 TO 2.50	2.	99.5	4.30 TO 4.40	0.	99.9
-1.30 TO -1.20	0.	0.0	.60 TO .70	76.	57.5	2.50 TO 2.60	1.	99.6	4.40 TO 4.50	0.	99.9
-1.20 TO -1.10	0.	0.0	.70 TO .80	86.	67.8	2.60 TO 2.70	0.	99.6	4.50 TO 4.60	0.	99.9

NUMRER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 128
- R. ITERATIVE PROCFS FAILED- 39

Fig 2-29

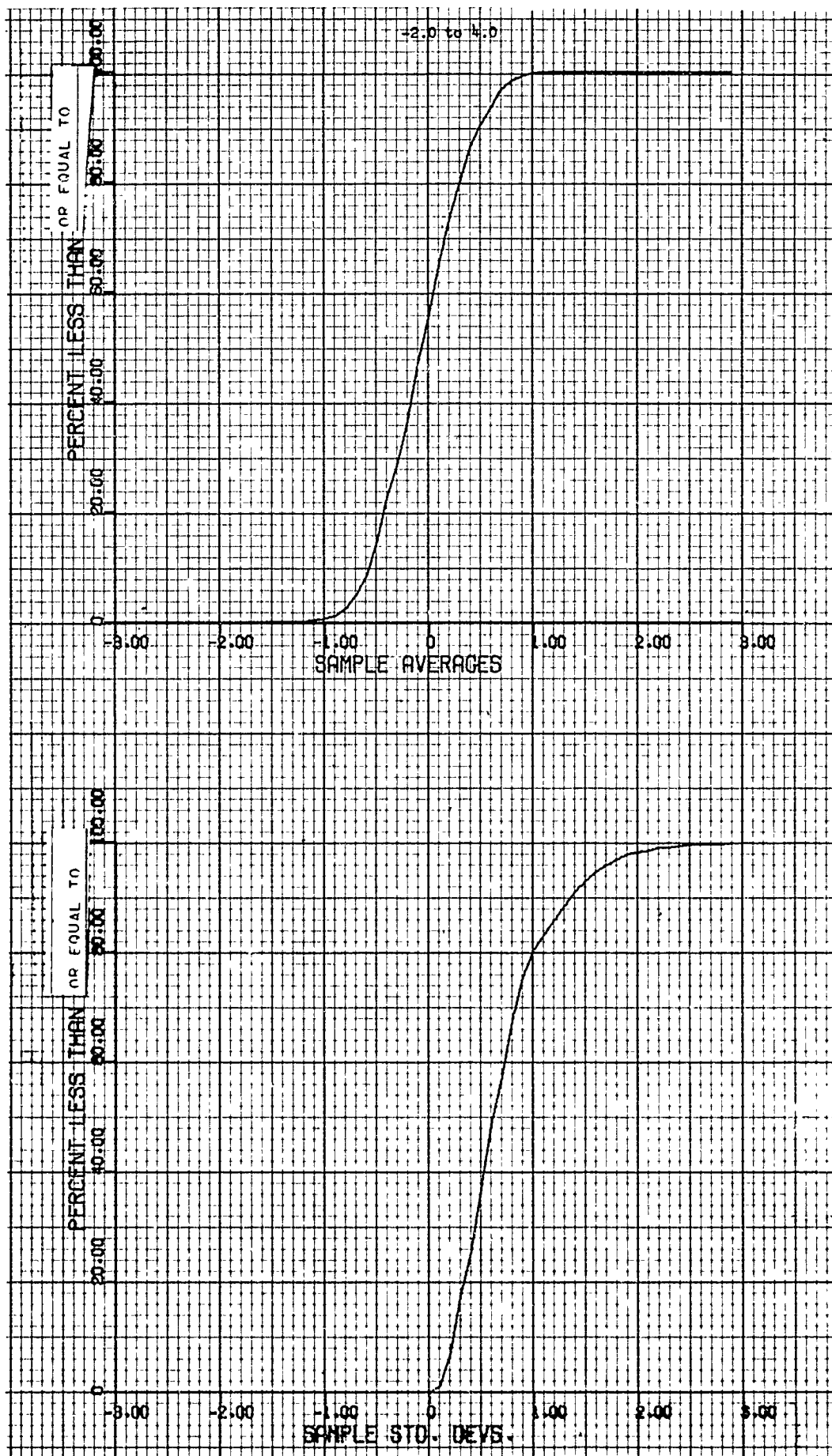


Fig 2-30

THE DATA REPRESENTED BELOW HAS A TRUE V50 OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIF SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -3.00 AND 4.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	3.	1.9	.80 TO .90	4.	99.2	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	4.	1.4	.90 TO 1.00	5.	99.9	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	9.	2.5	1.00 TO 1.10	0.	99.9	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	12.	4.0	1.10 TO 1.20	1.	100.0	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	30.	7.8	1.20 TO 1.30	0.	100.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	27.	11.2	1.30 TO 1.40	0.	100.0	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	34.	15.5	1.40 TO 1.50	0.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	55.	22.4	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	67.	30.9	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	49.	37.0	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	83.	47.5	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	86.	58.3	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	49.	64.5	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	104.	77.6	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	58.	84.9	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	1.	.1	.40 TO .50	32.	88.9	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	.1	.50 TO .60	26.	92.2	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	.1	.60 TO .70	19.	94.6	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	3.	.5	.70 TO .80	33.	98.7	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	58.	69.5	2.70 TO 2.80	2.	100.0
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	54.	74.3	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	49.	82.5	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	28.	86.0	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	14.	88.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	14.	90.3	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	26.	92.6	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	12.	95.1	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	8.	96.1	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	10.	97.4	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	7.	98.2	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	27.	3.4	1.90 TO 2.00	2.	99.5	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	18.	5.7	2.00 TO 2.10	2.	99.7	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	67.	14.1	2.10 TO 2.20	2.	99.9	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	84.	24.7	2.20 TO 2.30	2.	99.2	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	75.	34.6	2.30 TO 2.40	1.	99.6	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.0	.50 TO .60	56.	41.7	2.40 TO 2.50	0.	99.6	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	0.0	.60 TO .70	108.	55.3	2.50 TO 2.60	1.	99.7	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	0.	0.0	.70 TO .80	55.	62.2	2.60 TO 2.70	0.	99.7	4.50 TO 4.60	0.	100.0

NUMBER OF TIMES IN 1000 IN WHICH  
 A. THERE WAS NO OVERLAP----- 1747  
 B. ITERATIVE PROCESS FAILED- 50

Fg 2-31

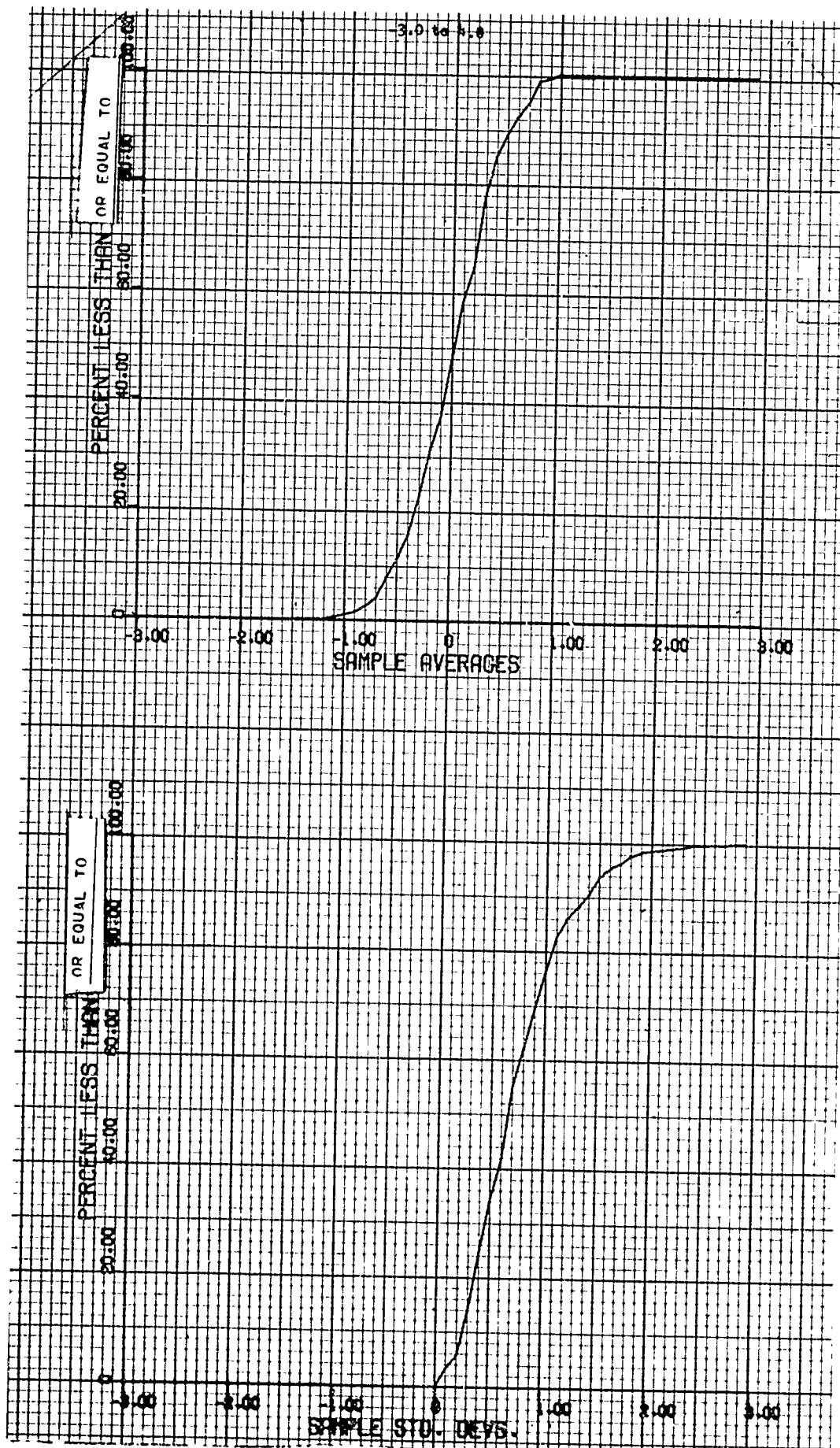


Fig 2-32

THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -4.00 AND 4.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	3.	1.2	.80 TO .90	4.	94.8	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	0.0	-.90 TO -.80	5.	1.7	.90 TO 1.00	7.	95.7	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.80 TO -.70	15.	3.5	1.00 TO 1.10	1.	95.8	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.70 TO -.60	10.	4.6	1.10 TO 1.20	2.	100.0	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.60 TO -.50	28.	7.9	1.20 TO 1.30	0.	100.0	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.50 TO -.40	24.	10.7	1.30 TO 1.40	0.	100.0	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.40 TO -.30	69.	13.1	1.40 TO 1.50	0.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.30 TO -.20	79.	21.1	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.20 TO -.10	68.	30.3	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.10 TO .00	105.	38.2	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	.00 TO .10	111.	50.4	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.10 TO .20	75.	63.3	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.20 TO .30	65.	72.0	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.30 TO .40	67.	79.6	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.40 TO .50	38.	87.3	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.50 TO .60	33.	91.2	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.0	.60 TO .70	18.	95.6	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	1.	.1	.70 TO .80	6.	97.7	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	6.	.8	.80 TO .90	0.	98.4	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	52.	70.6	2.70 TO 2.80	0.	99.9
-2.90 TO -2.80	0.	0.0	-.90 TO -.80	0.	0.0	.90 TO 1.00	41.	75.4	2.80 TO 2.90	1.	100.0
-2.80 TO -2.70	0.	0.0	-.80 TO -.70	0.	0.0	1.00 TO 1.10	50.	81.2	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.70 TO -.60	0.	0.0	1.10 TO 1.20	49.	86.9	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.60 TO -.50	0.	0.0	1.20 TO 1.30	15.	88.6	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.50 TO -.40	0.	0.0	1.30 TO 1.40	25.	91.5	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.40 TO -.30	0.	0.0	1.40 TO 1.50	1.	92.5	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.30 TO -.20	0.	0.0	1.50 TO 1.60	11.	94.1	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.20 TO -.10	0.	0.0	1.60 TO 1.70	16.	95.9	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.10 TO .00	0.	0.0	1.70 TO 1.80	5.	96.5	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	.00 TO .10	0.	0.0	1.80 TO 1.90	12.	97.9	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.10 TO .20	4.	5.	1.90 TO 2.00	4.	98.4	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.20 TO .30	47.	5.9	2.00 TO 2.10	5.	99.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.30 TO .40	58.	12.7	2.10 TO 2.20	4.	99.4	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.40 TO .50	72.	21.0	2.20 TO 2.30	1.	99.5	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.50 TO .60	83.	30.7	2.30 TO 2.40	2.	99.8	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.0	.60 TO .70	109.	43.3	2.40 TO 2.50	1.	99.9	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	0.0	.70 TO .80	116.	51.1	2.50 TO 2.60	0.	99.9	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	0.	0.0	.80 TO .90	116.	64.6	2.60 TO 2.70	0.	99.9	4.50 TO 4.60	0.	100.0

NUMBER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 104
- B. ITERATIVE PROCESS FAILED- 35

Fig 2-33



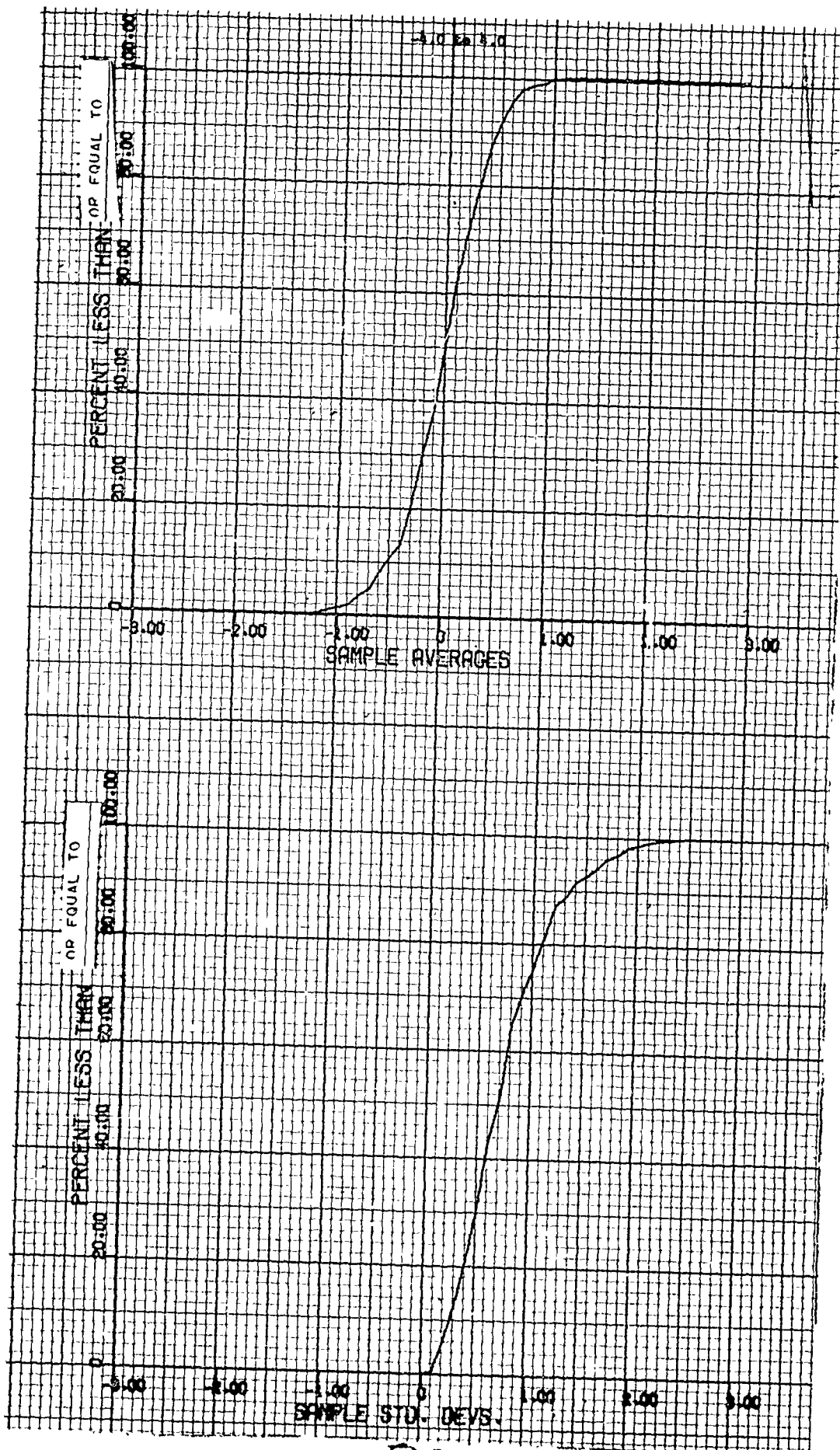


Fig 2-34



THE DATA REPRESENTED BELOW HAS A TRUE STD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 10, 8, 6, 4, 3, 2, 1 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 0.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	1	2.1	-1.10 TO -1.00	6	7.3	.80 TO .90	0	.1	2.70 TO 2.80	0	100.0
-2.90 TO -2.80	1	2.3	-1.00 TO -.90	3	8.0	.90 TO 1.00	1	99.3	2.80 TO 2.90	0	100.0
-2.80 TO -2.70	1	2.5	-.90 TO -.80	2	8.5	1.00 TO 1.10	1	99.5	2.90 TO 3.00	0	100.0
-2.70 TO -2.60	0	2.5	-.80 TO -.70	0	8.5	1.10 TO 1.20	0	99.5	3.00 TO 3.10	0	100.0
-2.60 TO -2.50	2	3.0	-.70 TO -.60	0	8.5	1.20 TO 1.30	1	99.8	3.10 TO 3.20	0	100.0
-2.50 TO -2.40	5	4.1	-.60 TO -.50	5	9.6	1.30 TO 1.40	1	100.0	3.20 TO 3.30	0	100.0
-2.40 TO -2.30	3	4.8	-.50 TO -.40	1	9.6	1.40 TO 1.50	0	100.0	3.30 TO 3.40	0	100.0
-2.30 TO -2.20	2	5.3	-.40 TO -.30	26	15.8	1.50 TO 1.60	0	100.0	3.40 TO 3.50	0	100.0
-2.20 TO -2.10	1	5.5	-.30 TO -.20	14	19.0	1.60 TO 1.70	0	100.0	3.50 TO 3.60	0	100.0
-2.10 TO -2.00	0	5.5	-.20 TO -.10	18	23.1	1.70 TO 1.80	0	100.0	3.60 TO 3.70	0	100.0
-2.00 TO -1.90	0	5.5	-.10 TO .00	40	32.3	1.80 TO 1.90	0	100.0	3.70 TO 3.80	0	100.0
-1.90 TO -1.80	0	5.5	.00 TO .10	95	54.0	1.90 TO 2.00	0	100.0	3.80 TO 3.90	0	100.0
-1.80 TO -1.70	0	5.5	.10 TO .20	52	65.9	2.00 TO 2.10	0	100.0	3.90 TO 4.00	0	100.0
-1.70 TO -1.60	1	5.7	.20 TO .30	48	76.9	2.10 TO 2.20	0	100.0	4.00 TO 4.10	0	100.0
-1.60 TO -1.50	0	5.7	.30 TO .40	41	86.3	2.20 TO 2.30	0	100.0	4.10 TO 4.20	0	100.0
-1.50 TO -1.40	0	5.7	.40 TO .50	29	92.9	2.30 TO 2.40	0	100.0	4.20 TO 4.30	0	100.0
-1.40 TO -1.30	0	5.7	.50 TO .60	13	95.9	2.40 TO 2.50	0	100.0	4.30 TO 4.40	0	100.0
-1.30 TO -1.20	0	5.7	.60 TO .70	8	97.7	2.50 TO 2.60	0	100.0	4.40 TO 4.50	0	100.0
-1.20 TO -1.10	1	5.9	.70 TO .80	6	99.1	2.60 TO 2.70	0	100.0	4.50 TO 4.60	0	100.0

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	.80 TO .90	27	69.1	2.70 TO 2.80	0	93.6
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	.90 TO 1.00	21	77.9	2.80 TO 2.90	0	93.6
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	1.00 TO 1.10	11	76.4	2.90 TO 3.00	0	93.6
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	1.10 TO 1.20	8	78.3	3.00 TO 3.10	0	93.6
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	1.20 TO 1.30	11	80.8	3.10 TO 3.20	1	93.6
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	1.30 TO 1.40	7	82.4	3.20 TO 3.30	0	93.6
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	1.40 TO 1.50	6	83.8	3.30 TO 3.40	0	93.6
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	1.50 TO 1.60	11	86.3	3.40 TO 3.50	1	94.1
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	1.60 TO 1.70	9	88.3	3.50 TO 3.60	0	94.1
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	1.70 TO 1.80	4	89.2	3.60 TO 3.70	0	94.1
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	1.80 TO 1.90	4	90.2	3.70 TO 3.80	1	94.3
-1.90 TO -1.80	0	0.0	.00 TO .10	30	6.0	1.90 TO 2.00	0	90.2	3.80 TO 3.90	1	94.5
-1.80 TO -1.70	0	0.0	.10 TO .20	46	17.4	2.00 TO 2.10	4	91.1	3.90 TO 4.00	0	94.5
-1.70 TO -1.60	0	0.0	.20 TO .30	32	24.7	2.10 TO 2.20	4	92.0	4.00 TO 4.10	2	95.0
-1.60 TO -1.50	0	0.0	.30 TO .40	52	36.6	2.20 TO 2.30	2	92.4	4.10 TO 4.20	4	95.9
-1.50 TO -1.40	0	0.0	.40 TO .50	35	44.6	2.30 TO 2.40	2	92.9	4.20 TO 4.30	4	96.4
-1.40 TO -1.30	0	0.0	.50 TO .60	34	52.4	2.40 TO 2.50	3	93.6	4.30 TO 4.40	2	97.3
-1.30 TO -1.20	0	0.0	.60 TO .70	18	56.5	2.50 TO 2.60	0	93.6	4.40 TO 4.50	0	97.3
-1.20 TO -1.10	0	0.0	.70 TO .80	28	62.9	2.60 TO 2.70	0	93.6	4.50 TO 4.60	1	97.5

NUMBER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 70
- B. ITERATIVE PROCESS FAILED- 493

Fig 3-1

### III. Sample Statistics: Five Percent Random Malfunction Rate

In this section data is presented with the same assumptions as in Section II except that it is assumed that there exists a random five percent malfunction rate which can occur at any velocity level.

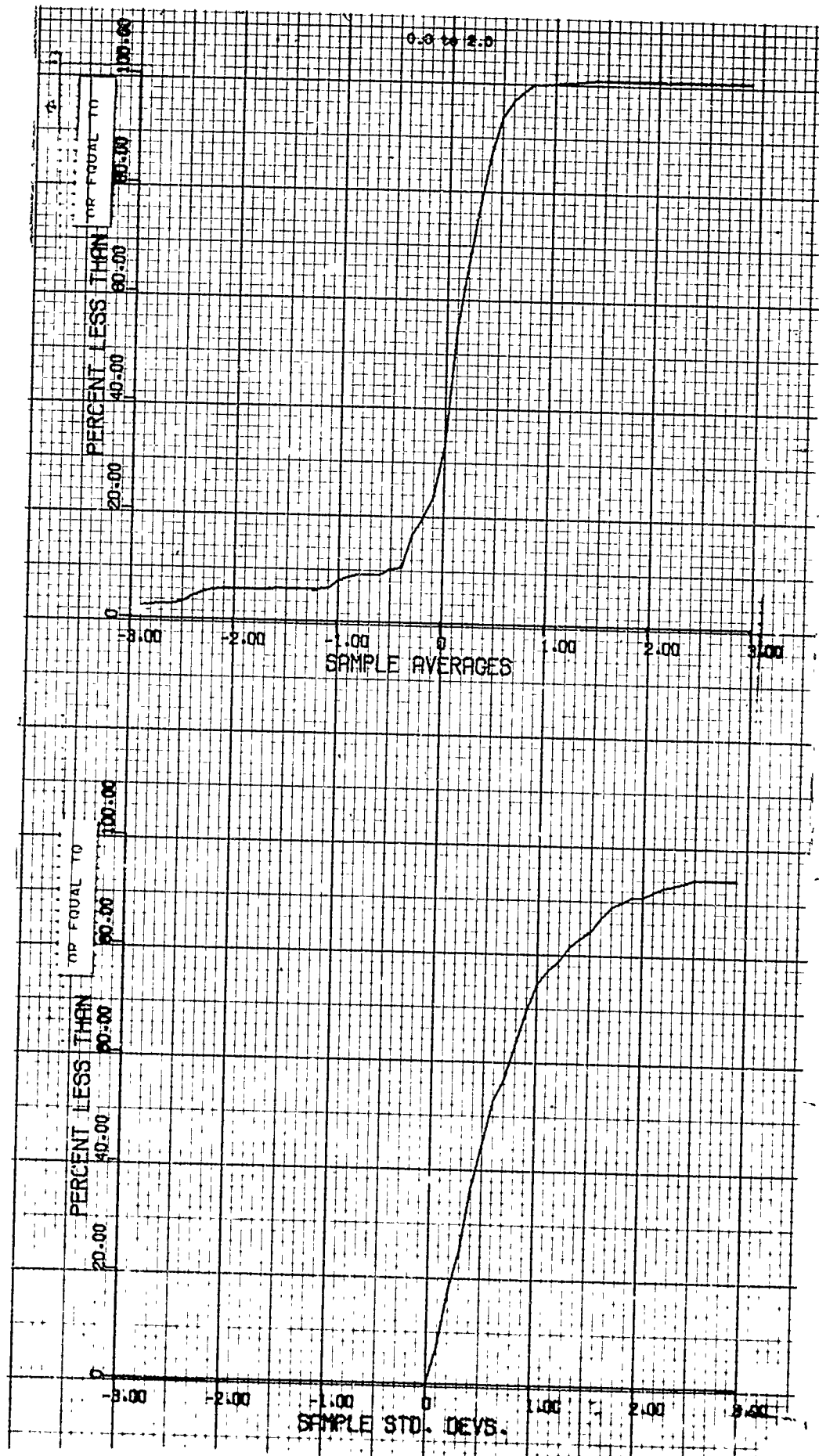


Fig 3-2

THE DATA REPRESENTED BELOW HAS A TRUE  $\mu$  OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -1.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.	-1.10 TO -1.00	1.	0.8	.80 TO .90	12.	98.4	2.70 TO 2.80	0.	99.9
-2.90 TO -2.80	0.	0.	-1.00 TO -.90	4.	1.3	.90 TO 1.00	8.	98.4	2.80 TO 2.90	0.	99.9
-2.80 TO -2.70	0.	0.	-.90 TO -.80	6.	2.1	1.00 TO 1.10	3.	99.8	2.90 TO 3.00	0.	99.9
-2.70 TO -2.60	0.	0.	-.80 TO -.70	8.	3.0	1.10 TO 1.20	1.	98.9	3.00 TO 3.10	0.	99.9
-2.60 TO -2.50	0.	0.	-.70 TO -.60	18.	5.2	1.20 TO 1.30	0.	98.9	3.10 TO 3.20	0.	99.9
-2.50 TO -2.40	0.	0.	-.60 TO -.50	18.	7.4	1.30 TO 1.40	0.	98.9	3.20 TO 3.30	0.	99.9
-2.40 TO -2.30	0.	0.	-.50 TO -.40	49.	13.3	1.40 TO 1.50	0.	98.9	3.30 TO 3.40	0.	99.9
-2.30 TO -2.20	0.	0.	-.40 TO -.30	42.	18.4	1.50 TO 1.60	0.	98.9	3.40 TO 3.50	0.	99.9
-2.20 TO -2.10	0.	0.	-.30 TO -.20	80.	28.1	1.60 TO 1.70	0.	98.9	3.50 TO 3.60	0.	99.9
-2.10 TO -2.00	0.	0.	-.20 TO -.10	73.	36.9	1.70 TO 1.80	0.	98.9	3.60 TO 3.70	0.	99.9
-2.00 TO -1.90	1.	0.	-.10 TO .00	71.	45.5	1.80 TO 1.90	0.	98.9	3.70 TO 3.80	0.	99.9
-1.90 TO -1.80	0.	0.	.00 TO .10	96.	57.1	1.90 TO 2.00	0.	98.9	3.80 TO 3.90	0.	99.9
-1.80 TO -1.70	0.	0.	.10 TO .20	83.	67.2	2.00 TO 2.10	0.	98.9	3.90 TO 4.00	0.	99.9
-1.70 TO -1.60	1.	0.	.20 TO .30	85.	77.5	2.10 TO 2.20	0.	98.9	4.00 TO 4.10	0.	99.9
-1.60 TO -1.50	0.	0.	.30 TO .40	66.	85.5	2.20 TO 2.30	0.	98.9	4.10 TO 4.20	0.	99.9
-1.50 TO -1.40	1.	0.	.40 TO .50	40.	90.3	2.30 TO 2.40	0.	98.9	4.20 TO 4.30	0.	99.9
-1.40 TO -1.30	2.	0.	.50 TO .60	27.	93.6	2.40 TO 2.50	0.	98.9	4.30 TO 4.40	0.	99.9
-1.30 TO -1.20	0.	0.	.60 TO .70	18.	95.8	2.50 TO 2.60	0.	98.9	4.40 TO 4.50	0.	99.9
-1.20 TO -1.10	0.	0.	.70 TO .80	10.	97.0	2.60 TO 2.70	0.	98.9	4.50 TO 4.60	0.	99.9

# STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	54.	75.1	2.70 TO 2.80	2.	98.4
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	31.	78.8	2.80 TO 2.90	2.	98.7
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	34.	82.9	2.90 TO 3.00	0.	98.7
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	27.	85.8	3.00 TO 3.10	0.	98.7
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	14.	90.8	3.10 TO 3.20	1.	98.8
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	8.	91.8	3.20 TO 3.30	0.	98.9
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	14.	93.5	3.30 TO 3.40	0.	98.9
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	9.	94.6	3.40 TO 3.50	0.	98.9
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	2.	96.8	3.50 TO 3.60	0.	98.9
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	4.	98.3	3.60 TO 3.70	0.	98.9
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	4.	98.3	3.70 TO 3.80	0.	98.9
-1.90 TO -1.80	0.	0.0	.00 TO .10	45.	5.4	1.90 TO 2.00	2.	98.5	3.80 TO 3.90	0.	98.9
-1.80 TO -1.70	0.	0.0	.10 TO .20	81.	15.3	2.00 TO 2.10	5.	96.1	3.90 TO 4.00	1.	99.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	94.	26.6	2.10 TO 2.20	2.	98.4	4.00 TO 4.10	0.	99.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	87.	37.2	2.20 TO 2.30	4.	96.9	4.10 TO 4.20	0.	99.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	84.	47.3	2.30 TO 2.40	0.	96.9	4.20 TO 4.30	0.	99.0
-1.40 TO -1.30	0.	0.0	.50 TO .60	61.	54.7	2.40 TO 2.50	4.	97.6	4.30 TO 4.40	0.	99.0
-1.30 TO -1.20	0.	0.0	.60 TO .70	73.	63.6	2.50 TO 2.60	4.	98.1	4.40 TO 4.50	0.	99.0
-1.20 TO -1.10	0.	0.0	.70 TO .80	41.	68.5	2.60 TO 2.70	1.	98.2	4.50 TO 4.60	0.	99.0

NUMBER OF TIMES IN 1000 IN WHICH

A. THERE WAS NO OVERLAP----- 54

B. ITERATIVE PROCESS FAILED- 118

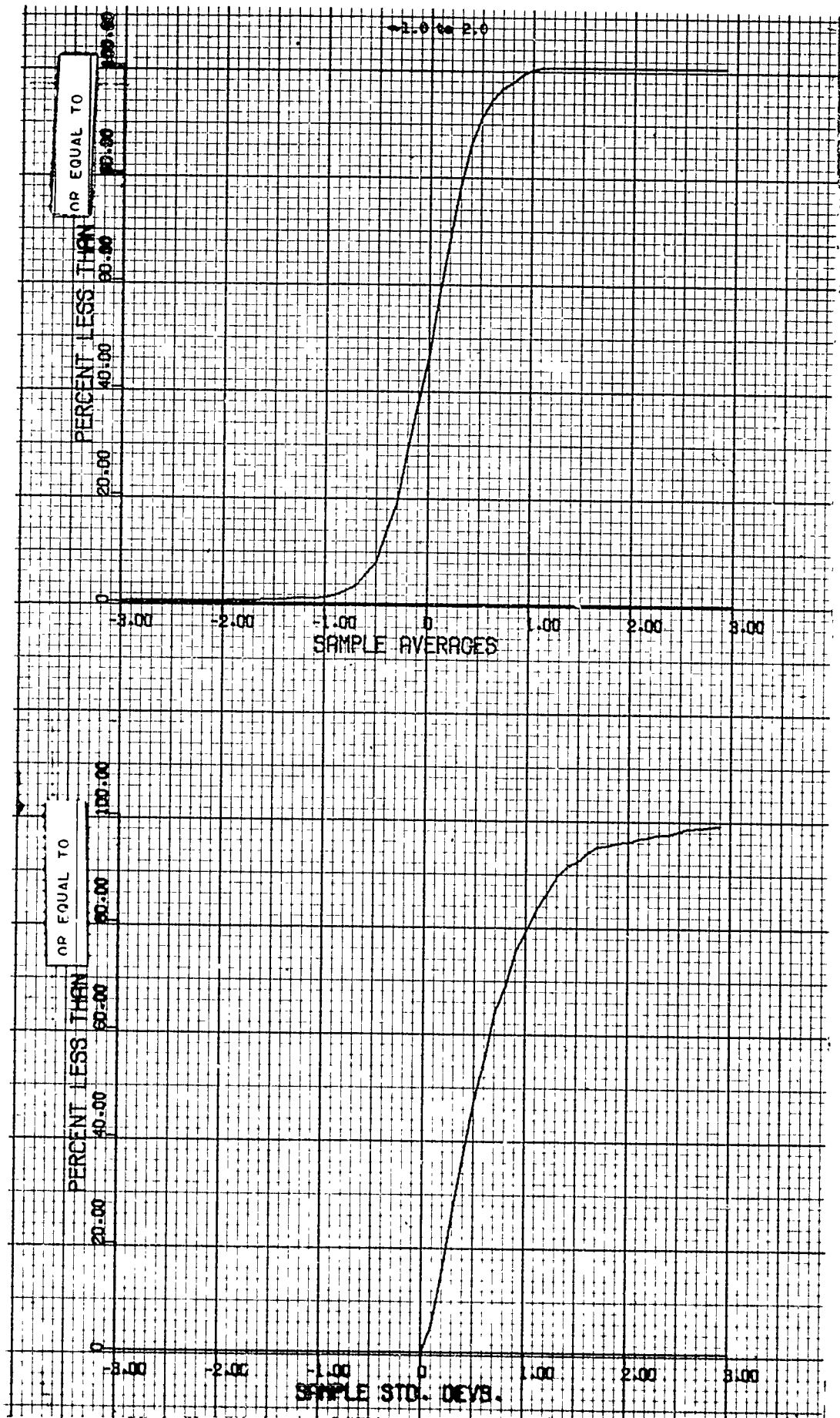


Fig 3-K

\*\*\*\*\*  
 THE DATA REPRESENTED BELOW HAS A TRUE VSD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIF SENSITIVITY  
 TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 2.00 AND 2.00 RESPECTIVELY.  
 THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.  
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AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	1.	.2	.80 TO .90	8.	98.7	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	1.	.4	.90 TO 1.00	5.	98.3	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	7.	1.2	1.00 TO 1.10	2.	99.5	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	8.	2.1	1.10 TO 1.20	2.	99.8	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	18.	4.2	1.20 TO 1.30	1.	9.9	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	23.	6.9	1.30 TO 1.40	0.	99.9	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	36.	11.1	1.40 TO 1.50	1.	100.0	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	47.	16.6	1.50 TO 1.60	0.	100.0	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	70.	24.8	1.60 TO 1.70	0.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	76.	33.7	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	97.	45.0	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	98.	56.5	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	96.	67.7	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	79.	77.0	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	76.	85.8	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	46.	91.2	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.0	.50 TO .60	26.	94.3	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	0.0	.60 TO .70	19.	96.5	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	1.	.1	.70 TO .80	11.	97.8	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	83.	68.8	2.70 TO 2.80	0.	98.9
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	47.	74.3	2.80 TO 2.90	3.	99.3
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	55.	80.7	2.90 TO 3.00	0.	99.3
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	34.	84.7	3.00 TO 3.10	0.	99.3
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	20.	87.0	3.10 TO 3.20	1.	99.4
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	17.	89.0	3.20 TO 3.30	1.	99.5
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	14.	90.6	3.30 TO 3.40	0.	99.5
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	14.	92.3	3.40 TO 3.50	1.	99.6
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	20.	94.6	3.50 TO 3.60	1.	99.8
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	8.	95.6	3.60 TO 3.70	1.	99.9
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	6.	96.3	3.70 TO 3.80	0.	99.9
-1.90 TO -1.80	0.	0.0	.00 TO .10	12.	1.4	1.90 TO 2.00	5.	96.8	3.80 TO 3.90	1.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	56.	8.0	2.00 TO 2.10	5.	97.4	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	64.	15.4	2.10 TO 2.20	5.	98.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	77.	24.4	2.20 TO 2.30	3.	98.4	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	68.	32.4	2.30 TO 2.40	4.	98.8	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.0	.50 TO .60	101.	44.2	2.40 TO 2.50	1.	98.9	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	0.0	.60 TO .70	82.	53.8	2.50 TO 2.60	0.	98.9	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	0.	0.0	.70 TO .80	45.	59.1	2.60 TO 2.70	0.	98.9	4.50 TO 4.60	0.	100.0

NUMBER OF TIMES IN 1000 IN WHICH

- A. THERE WAS NO OVERLAP----- 76
- B. ITERATIVE PROCESS FAILED-- 69

Fig 5

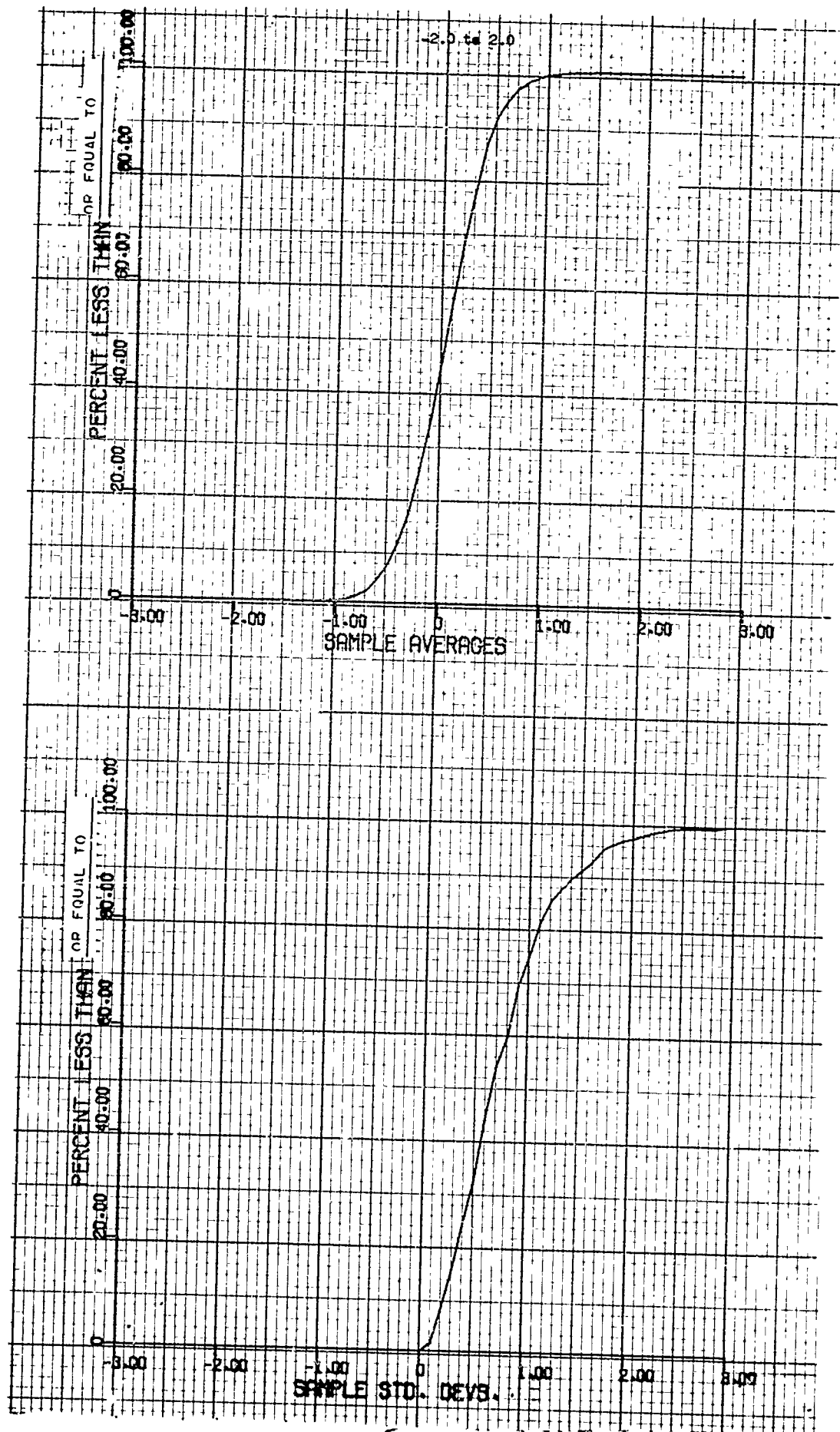


Fig 3-6

#### IV. Sample Statistics: Ten Percent Random Malfunction Rate

In this section data is presented with same assumptions as in Section II except that it is assumed that there exists a random ten percent malfunction rate which can occur at any velocity level.



THE DATA REPRESENTED BELOW HAS A TRUE STD OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIE SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 0.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVRAGES

INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT
-3.00 TO -2.90	1	2.0	-1.10 TO -1.00	2	7.2	.80 TO .90	8	97.8	2.70 TO 2.80	0	100.0
-2.90 TO -2.80	0	2.0	-1.00 TO -.90	3	7.5	.90 TO 1.00	3	98.5	2.80 TO 2.90	0	100.0
-2.80 TO -2.70	1	2.2	-.90 TO -.80	1	8.1	1.00 TO 1.10	2	98.9	2.90 TO 3.00	0	100.0
-2.70 TO -2.60	0	2.2	-.80 TO -.70	1	8.3	1.10 TO 1.20	3	99.6	3.00 TO 3.10	0	100.0
-2.60 TO -2.50	2	2.6	-.70 TO -.60	0	8.3	1.20 TO 1.30	1	99.8	3.10 TO 3.20	0	100.0
-2.50 TO -2.40	4	3.5	-.60 TO -.50	4	9.7	1.30 TO 1.40	0	99.8	3.20 TO 3.30	0	100.0
-2.40 TO -2.30	3	4.2	-.50 TO -.40	2	9.6	1.40 TO 1.50	0	99.8	3.30 TO 3.40	0	100.0
-2.30 TO -2.20	1	4.8	-.40 TO -.30	29	16.0	1.50 TO 1.60	1	100.0	3.40 TO 3.50	0	100.0
-2.20 TO -2.10	1	5.0	-.30 TO -.20	12	18.6	1.60 TO 1.70	0	100.0	3.50 TO 3.60	0	100.0
-2.10 TO -2.00	0	5.0	-.20 TO -.10	16	22.1	1.70 TO 1.80	0	100.0	3.60 TO 3.70	0	100.0
-2.00 TO -1.90	1	5.3	-.10 TO .00	39	30.6	1.80 TO 1.90	0	100.0	3.70 TO 3.80	0	100.0
-1.90 TO -1.80	0	5.3	.00 TO .10	53	42.2	1.90 TO 2.00	0	100.0	3.80 TO 3.90	0	100.0
-1.80 TO -1.70	0	5.3	.10 TO .20	58	54.9	2.00 TO 2.10	0	100.0	3.90 TO 4.00	0	100.0
-1.70 TO -1.60	2	5.7	.20 TO .30	73	70.9	2.10 TO 2.20	0	100.0	4.00 TO 4.10	0	100.0
-1.60 TO -1.50	2	6.1	.30 TO .40	41	79.9	2.20 TO 2.30	0	100.0	4.10 TO 4.20	0	100.0
-1.50 TO -1.40	0	6.1	.40 TO .50	35	87.5	2.30 TO 2.40	0	100.0	4.20 TO 4.30	0	100.0
-1.40 TO -1.30	1	6.3	.50 TO .60	18	91.5	2.40 TO 2.50	0	100.0	4.30 TO 4.40	0	100.0
-1.30 TO -1.20	2	6.8	.60 TO .70	11	93.9	2.50 TO 2.60	0	100.0	4.40 TO 4.50	0	100.0
-1.20 TO -1.10	0	6.8	.70 TO .80	10	96.1	2.60 TO 2.70	0	100.0	4.50 TO 4.60	0	100.0

Fig 4-1

## STANDARD DEVIATIONS

INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT	INTERVAL	FRQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	.80 TO .90	23	60.6	2.70 TO 2.80	0	91.7
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	.90 TO 1.00	33	67.8	2.80 TO 2.90	1	91.9
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	1.00 TO 1.10	12	70.5	2.90 TO 3.00	0	91.9
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	1.10 TO 1.20	11	72.9	3.00 TO 3.10	0	91.9
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	1.20 TO 1.30	12	75.5	3.10 TO 3.20	2	92.3
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	1.30 TO 1.40	7	77.0	3.20 TO 3.30	2	92.8
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	1.40 TO 1.50	7	78.6	3.30 TO 3.40	0	92.8
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	1.50 TO 1.60	15	81.8	3.40 TO 3.50	0	92.8
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	1.60 TO 1.70	17	85.6	3.50 TO 3.60	0	92.8
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	1.70 TO 1.80	8	87.3	3.60 TO 3.70	0	92.8
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	1.80 TO 1.90	5	88.4	3.70 TO 3.80	1	93.0
-1.90 TO -1.80	0	0.0	.00 TO .10	18	3.0	1.90 TO 2.00	3	89.1	3.80 TO 3.90	0	93.0
-1.80 TO -1.70	0	0.0	.10 TO .20	31	10.7	2.00 TO 2.10	2	89.5	3.90 TO 4.00	0	93.0
-1.70 TO -1.60	0	0.0	.20 TO .30	36	18.6	2.10 TO 2.20	3	90.6	4.00 TO 4.10	2	93.4
-1.60 TO -1.50	0	0.0	.30 TO .40	60	31.7	2.20 TO 2.30	3	91.2	4.10 TO 4.20	4	94.3
-1.50 TO -1.40	0	0.0	.40 TO .50	42	40.9	2.30 TO 2.40	1	91.5	4.20 TO 4.30	3	95.0
-1.40 TO -1.30	0	0.0	.50 TO .60	27	46.8	2.40 TO 2.50	0	91.5	4.30 TO 4.40	2	95.4
-1.30 TO -1.20	0	0.0	.60 TO .70	9	48.8	2.50 TO 2.60	1	91.7	4.40 TO 4.50	1	95.8
-1.20 TO -1.10	0	0.0	.70 TO .80	31	55.6	2.60 TO 2.70	0	91.7	4.50 TO 4.60	0	95.6

NUMBER OF TIMES IN 1000 IN WHICH

A. THERE WAS NO OVERLAP --- 55  
B. ITERATIVE PROCESS FAILED- 489

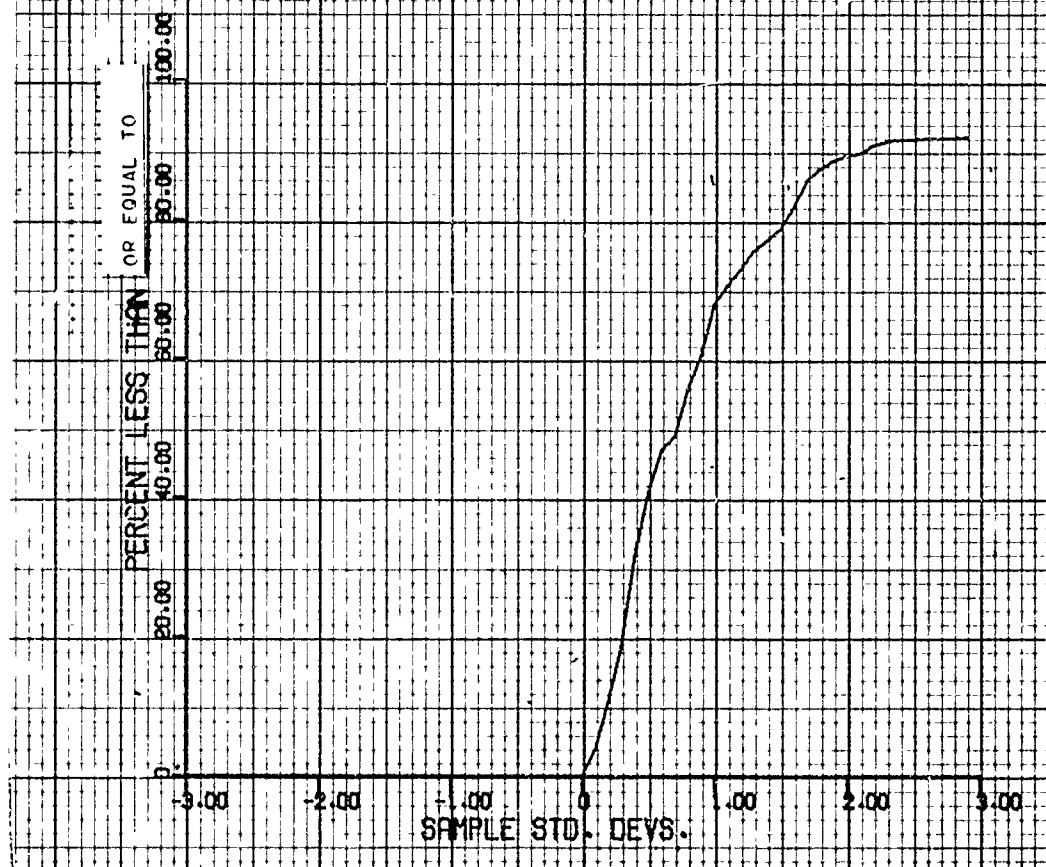
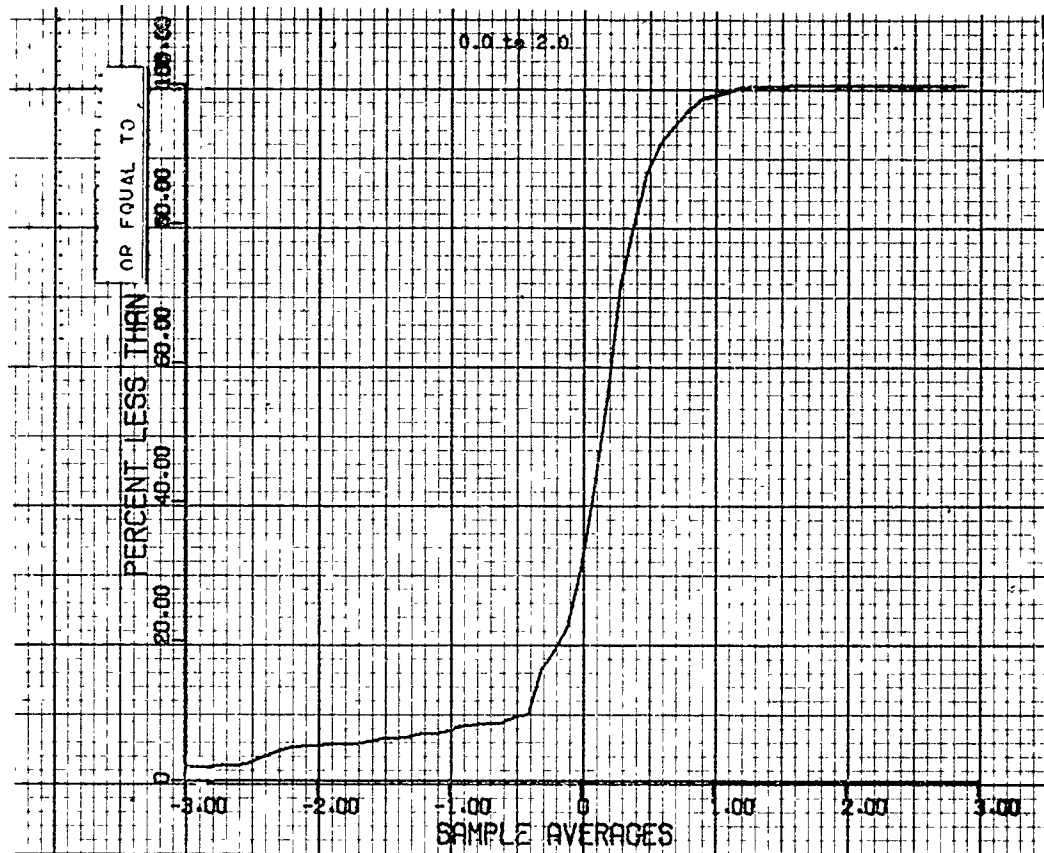


Fig 4-2

THE DATA REPRESENTED BELOW WAS A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEIF SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 100 TIMES. THE MINIMUM AND MAXIMUM GATES WERE -1.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT
-3.00 TO -2.00	0.0	-1.10 TO -1.00	2.0	1.1	.90 TO .90	12.0	97.6
-2.00 TO -1.00	0.0	-1.00 TO -.90	1.0	1.0	.90 TO 1.00	10.0	98.9
-1.00 TO -.90	0.0	-.90 TO -.80	5.0	1.0	1.00 TO 1.10	2.0	99.1
-.90 TO -.80	0.0	-.80 TO -.70	6.0	2.7	1.10 TO 1.20	4.0	99.6
-.70 TO -.60	0.0	-.60 TO -.50	14.0	4.4	1.20 TO 1.30	0.0	99.9
-.50 TO -.40	0.0	-.40 TO -.30	15.0	6.1	1.30 TO 1.40	0.0	99.9
-.30 TO -.20	0.0	-.20 TO -.10	27.0	9.7	1.40 TO 1.50	1.0	99.7
-.10 TO 0.00	0.0	0.00 TO .10	45.0	15.4	1.50 TO 1.60	0.0	99.7
0.10 TO .20	0.0	.10 TO .20	59.0	22.9	1.60 TO 1.70	0.0	99.7
0.20 TO .30	0.0	.20 TO .30	63.0	30.8	1.70 TO 1.80	0.0	99.7
0.30 TO .40	0.0	.30 TO .40	65.0	39.0	1.80 TO 1.90	1.0	99.9
0.40 TO .50	0.0	.40 TO .50	71.0	48.0	1.90 TO 2.00	0.0	99.9
0.50 TO .60	0.0	.50 TO .60	76.0	57.6	2.00 TO 2.10	0.0	99.9
0.60 TO .70	0.0	.60 TO .70	78.0	67.4	2.10 TO 2.20	0.0	99.9
0.70 TO .80	0.0	.70 TO .80	83.0	79.2	2.20 TO 2.30	0.0	99.9
0.80 TO .90	0.0	.80 TO .90	84.0	89.1	2.30 TO 2.40	0.0	99.9
0.90 TO 1.00	0.0	.90 TO 1.00	89.0	92.9	2.40 TO 2.50	0.0	99.9
1.00 TO 1.10	0.0	1.00 TO 1.10	96.1	96.1	2.50 TO 2.60	0.0	99.9
1.10 TO 1.20	0.0	1.10 TO 1.20	97.6	97.6	2.60 TO 2.70	0.0	99.9
1.20 TO 1.30	0.0	1.20 TO 1.30	98.9	98.9	2.70 TO 2.80	0.0	99.9
1.30 TO 1.40	0.0	1.30 TO 1.40	99.1	99.1	2.80 TO 2.90	0.0	99.9
1.40 TO 1.50	0.0	1.40 TO 1.50	99.6	99.6	2.90 TO 3.00	0.0	99.9
1.50 TO 1.60	0.0	1.50 TO 1.60	99.9	99.9	3.00 TO 3.10	0.0	99.9
1.60 TO 1.70	0.0	1.60 TO 1.70	99.9	99.9	3.10 TO 3.20	0.0	99.9
1.70 TO 1.80	0.0	1.70 TO 1.80	99.9	99.9	3.20 TO 3.30	0.0	99.9
1.80 TO 1.90	0.0	1.80 TO 1.90	99.9	99.9	3.30 TO 3.40	0.0	99.9
1.90 TO 2.00	0.0	1.90 TO 2.00	99.9	99.9	3.40 TO 3.50	0.0	99.9
2.00 TO 2.10	0.0	2.00 TO 2.10	99.9	99.9	3.50 TO 3.60	0.0	99.9
2.10 TO 2.20	0.0	2.10 TO 2.20	99.9	99.9	3.60 TO 3.70	0.0	99.9
2.20 TO 2.30	0.0	2.20 TO 2.30	99.9	99.9	3.70 TO 3.80	0.0	99.9
2.30 TO 2.40	0.0	2.30 TO 2.40	99.9	99.9	3.80 TO 3.90	0.0	99.9
2.40 TO 2.50	0.0	2.40 TO 2.50	99.9	99.9	3.90 TO 4.00	0.0	99.9
2.50 TO 2.60	0.0	2.50 TO 2.60	99.9	99.9	4.00 TO 4.10	0.0	99.9
2.60 TO 2.70	0.0	2.60 TO 2.70	99.9	99.9	4.10 TO 4.20	0.0	99.9
2.70 TO 2.80	0.0	2.70 TO 2.80	99.9	99.9	4.20 TO 4.30	0.0	99.9
2.80 TO 2.90	0.0	2.80 TO 2.90	99.9	99.9	4.30 TO 4.40	0.0	99.9
2.90 TO 3.00	0.0	2.90 TO 3.00	99.9	99.9	4.40 TO 4.50	0.0	99.9
3.00 TO 3.10	0.0	3.00 TO 3.10	99.9	99.9	4.50 TO 4.60	0.0	99.9
3.10 TO 3.20	0.0	3.10 TO 3.20	99.9	99.9	4.60 TO 4.70	0.0	99.9
3.20 TO 3.30	0.0	3.20 TO 3.30	99.9	99.9	4.70 TO 4.80	0.0	99.9
3.30 TO 3.40	0.0	3.30 TO 3.40	99.9	99.9	4.80 TO 4.90	0.0	99.9
3.40 TO 3.50	0.0	3.40 TO 3.50	99.9	99.9	4.90 TO 5.00	0.0	99.9
3.50 TO 3.60	0.0	3.50 TO 3.60	99.9	99.9	5.00 TO 5.10	0.0	99.9
3.60 TO 3.70	0.0	3.60 TO 3.70	99.9	99.9	5.10 TO 5.20	0.0	99.9
3.70 TO 3.80	0.0	3.70 TO 3.80	99.9	99.9	5.20 TO 5.30	0.0	99.9
3.80 TO 3.90	0.0	3.80 TO 3.90	99.9	99.9	5.30 TO 5.40	0.0	99.9
3.90 TO 4.00	0.0	3.90 TO 4.00	99.9	99.9	5.40 TO 5.50	0.0	99.9
4.00 TO 4.10	0.0	4.00 TO 4.10	99.9	99.9	5.50 TO 5.60	0.0	99.9
4.10 TO 4.20	0.0	4.10 TO 4.20	99.9	99.9	5.60 TO 5.70	0.0	99.9
4.20 TO 4.30	0.0	4.20 TO 4.30	99.9	99.9	5.70 TO 5.80	0.0	99.9
4.30 TO 4.40	0.0	4.30 TO 4.40	99.9	99.9	5.80 TO 5.90	0.0	99.9
4.40 TO 4.50	0.0	4.40 TO 4.50	99.9	99.9	5.90 TO 6.00	0.0	99.9
4.50 TO 4.60	0.0	4.50 TO 4.60	99.9	99.9	6.00 TO 6.10	0.0	99.9
4.60 TO 4.70	0.0	4.60 TO 4.70	99.9	99.9	6.10 TO 6.20	0.0	99.9
4.70 TO 4.80	0.0	4.70 TO 4.80	99.9	99.9	6.20 TO 6.30	0.0	99.9
4.80 TO 4.90	0.0	4.80 TO 4.90	99.9	99.9	6.30 TO 6.40	0.0	99.9
4.90 TO 5.00	0.0	4.90 TO 5.00	99.9	99.9	6.40 TO 6.50	0.0	99.9
5.00 TO 5.10	0.0	5.00 TO 5.10	99.9	99.9	6.50 TO 6.60	0.0	99.9
5.10 TO 5.20	0.0	5.10 TO 5.20	99.9	99.9	6.60 TO 6.70	0.0	99.9
5.20 TO 5.30	0.0	5.20 TO 5.30	99.9	99.9	6.70 TO 6.80	0.0	99.9
5.30 TO 5.40	0.0	5.30 TO 5.40	99.9	99.9	6.80 TO 6.90	0.0	99.9
5.40 TO 5.50	0.0	5.40 TO 5.50	99.9	99.9	6.90 TO 7.00	0.0	99.9
5.50 TO 5.60	0.0	5.50 TO 5.60	99.9	99.9	7.00 TO 7.10	0.0	99.9
5.60 TO 5.70	0.0	5.60 TO 5.70	99.9	99.9	7.10 TO 7.20	0.0	99.9
5.70 TO 5.80	0.0	5.70 TO 5.80	99.9	99.9	7.20 TO 7.30	0.0	99.9
5.80 TO 5.90	0.0	5.80 TO 5.90	99.9	99.9	7.30 TO 7.40	0.0	99.9
5.90 TO 6.00	0.0	5.90 TO 6.00	99.9	99.9	7.40 TO 7.50	0.0	99.9
6.00 TO 6.10	0.0	6.00 TO 6.10	99.9	99.9	7.50 TO 7.60	0.0	99.9
6.10 TO 6.20	0.0	6.10 TO 6.20	99.9	99.9	7.60 TO 7.70	0.0	99.9
6.20 TO 6.30	0.0	6.20 TO 6.30	99.9	99.9	7.70 TO 7.80	0.0	99.9
6.30 TO 6.40	0.0	6.30 TO 6.40	99.9	99.9	7.80 TO 7.90	0.0	99.9
6.40 TO 6.50	0.0	6.40 TO 6.50	99.9	99.9	7.90 TO 8.00	0.0	99.9
6.50 TO 6.60	0.0	6.50 TO 6.60	99.9	99.9	8.00 TO 8.10	0.0	99.9
6.60 TO 6.70	0.0	6.60 TO 6.70	99.9	99.9	8.10 TO 8.20	0.0	99.9
6.70 TO 6.80	0.0	6.70 TO 6.80	99.9	99.9	8.20 TO 8.30	0.0	99.9
6.80 TO 6.90	0.0	6.80 TO 6.90	99.9	99.9	8.30 TO 8.40	0.0	99.9
6.90 TO 7.00	0.0	6.90 TO 7.00	99.9	99.9	8.40 TO 8.50	0.0	99.9
7.00 TO 7.10	0.0	7.00 TO 7.10	99.9	99.9	8.50 TO 8.60	0.0	99.9
7.10 TO 7.20	0.0	7.10 TO 7.20	99.9	99.9	8.60 TO 8.70	0.0	99.9
7.20 TO 7.30	0.0	7.20 TO 7.30	99.9	99.9	8.70 TO 8.80	0.0	99.9
7.30 TO 7.40	0.0	7.30 TO 7.40	99.9	99.9	8.80 TO 8.90	0.0	99.9
7.40 TO 7.50	0.0	7.40 TO 7.50	99.9	99.9	8.90 TO 9.00	0.0	99.9
7.50 TO 7.60	0.0	7.50 TO 7.60	99.9	99.9	9.00 TO 9.10	0.0	99.9
7.60 TO 7.70	0.0	7.60 TO 7.70	99.9	99.9	9.10 TO 9.20	0.0	99.9
7.70 TO 7.80	0.0	7.70 TO 7.80	99.9	99.9	9.20 TO 9.30	0.0	99.9
7.80 TO 7.90	0.0	7.80 TO 7.90	99.9	99.9	9.30 TO 9.40	0.0	99.9
7.90 TO 8.00	0.0	7.90 TO 8.00	99.9	99.9	9.40 TO 9.50	0.0	99.9
8.00 TO 8.10	0.0	8.00 TO 8.10	99.9	99.9	9.50 TO 9.60	0.0	99.9
8.10 TO 8.20	0.0	8.10 TO 8.20	99.9	99.9	9.60 TO 9.70	0.0	99.9
8.20 TO 8.30	0.0	8.20 TO 8.30	99.9	99.9	9.70 TO 9.80	0.0	99.9
8.30 TO 8.40	0.0	8.30 TO 8.40	99.9	99.9	9.80 TO 9.90	0.0	99.9
8.40 TO 8.50	0.0	8.40 TO 8.50	99.9	99.9	9.90 TO 10.00	0.0	99.9
8.50 TO 8.60	0.0	8.50 TO 8.60	99.9	99.9	10.00 TO 10.10	0.0	99.9
8.60 TO 8.70	0.0	8.60 TO 8.70	99.9	99.9	10.10 TO 10.20	0.0	99.9
8.70 TO 8.80	0.0	8.70 TO 8.80	99.9	99.9	10.20 TO 10.30	0.0	99.9
8.80 TO 8.90	0.0	8.80 TO 8.90	99.9	99.9	10.30 TO 10.40	0.0	99.9
8.90 TO 9.00	0.0	8.90 TO 9.00	99.9	99.9	10.40 TO 10.50	0.0	99.9
9.00 TO 9.10	0.0	9.00 TO 9.10	99.9	99.9	10.50 TO 10.60	0.0	99.9
9.10 TO 9.20	0.0	9.10 TO 9.20	99.9	99.9	10.60 TO 10.70	0.0	99.9
9.20 TO 9.30	0.0	9.20 TO 9.30	99.9	99.9	10.70 TO 10.80	0.0	99.9
9.30 TO 9.40	0.0	9.30 TO 9.40	99.9	99.9	10.80 TO 10.90	0.0	99.9
9.40 TO 9.50	0.0	9.40 TO 9.50	99.9	99.9	10.90 TO 11.00	0.0	99.9
9.50 TO 9.60	0.0	9.50 TO 9.60	99.9	99.9	11.00 TO 11.10	0.0	99.9
9.60 TO 9.70	0.0	9.60 TO 9.70	99.9	99.9	11.10 TO 11.20	0.0	99.9
9.70 TO 9.80	0.0	9.70 TO 9.80	99.9	99.9	11.20 TO 11.30	0.0	99.9
9.80 TO 9.90	0.0	9.80 TO 9.90	99.9	99.9	11.30 TO 11.40	0.0	99.9
9.90 TO 10.00	0.0	9.90 TO 10.00	99.9	99.9	11.40 TO 11.50	0.0	99.9
10.00 TO 10.10	0.0	10.00 TO 10.10	99.9	99.9	11.50 TO 11.60	0.0	99.9
10.10 TO 10.20	0.0	10.10 TO 10.20	99.9	99.9	11.60 TO 11.70	0.0	99.9
10.20 TO 10.30	0.0	10.20 TO 10.30	99.9	99.9	11.70 TO 11.80	0.0	99.9
10.30 TO 10.40	0.0	10.30 TO 10.40	99.9	99.9	11.80 TO 11.90	0.0	99.9
10.40 TO 10.50	0.0	10.40 TO 10.50	99.9	99.9	11.90 TO 12.00	0.0	99.9
10.50 TO 10.60	0.0	10.50 TO 10.60	99.9	99.9	12.00 TO 12.10	0.0	99.9
10.60 TO 10.70	0.0	10.60 TO 10.70	99.9	99.9	12.10 TO 12.20	0.0	99.9
10.70 TO 10.80	0.0	10.70 TO 10.80	99.9	99.9	12.20 TO 12.30	0.0	99.9
10.80 TO 10.90	0.0	10.80 TO 10.90	99.9	99.9	12.30 TO 12.40	0.0	99.9
10.90 TO 11.00	0.0	10.90 TO 11.00	99.9	99.9	12.40 TO 12.50	0.0	99.9
11.00 TO 11.10	0.0	11.00 TO 11.10	99.9	99.9	12.50 TO 12.60	0.0	99.9
11.10 TO 11.20	0.0	11.10 TO 11.20	99.9	99.9	12.60 TO 12.70	0.0	99.9
11.20 TO 11.30	0.0	11.20 TO 11.30	99.9	99.9	12.70 TO 12.80	0.0	99.9
11.30 TO 11.40	0.0	11.30 TO 11.40	99.9	99.9	12.80 TO 12.90	0.0	99.9
11.40 TO 11.50	0.0	11.40 TO 11.50	99.9	99.9	12.90 TO 13.00	0.0	99.9
11.50 TO 11.60	0.0	11.50 TO 11.60	99.9	99.9	13.00 TO 13.10	0.0	99.9
11.60 TO 11.70	0.0	11.60 TO 11.70	99.9	99.9	13.10 TO 13.20	0.0	99.9
11.70 TO 11.80	0.0	11.70 TO 11.80	99.9	99.9	13.20 TO 13.30	0.0	99.9
11.80 TO 11.90	0.0	11.80 TO 11.90	99.9	99.9	13.30 TO 13.40	0.0	99.9
11.90 TO 12.00	0.0	11.90 TO 12.00	99.9	99.9	13.40 TO 13.50	0.0	99.9
12.00 TO 12.10	0.0	12.00 TO 12.10	99.9	99.9	13.50 TO 13.60	0.0	99.9
12.10 TO							

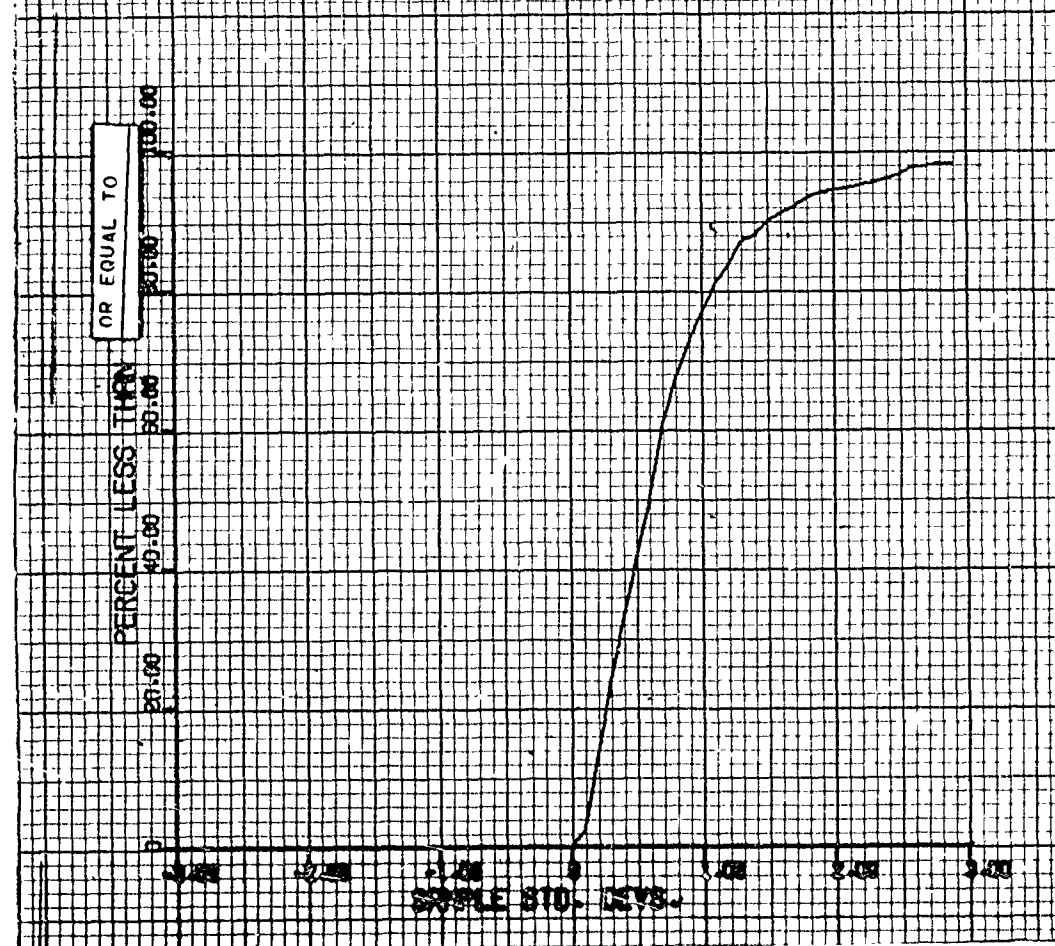
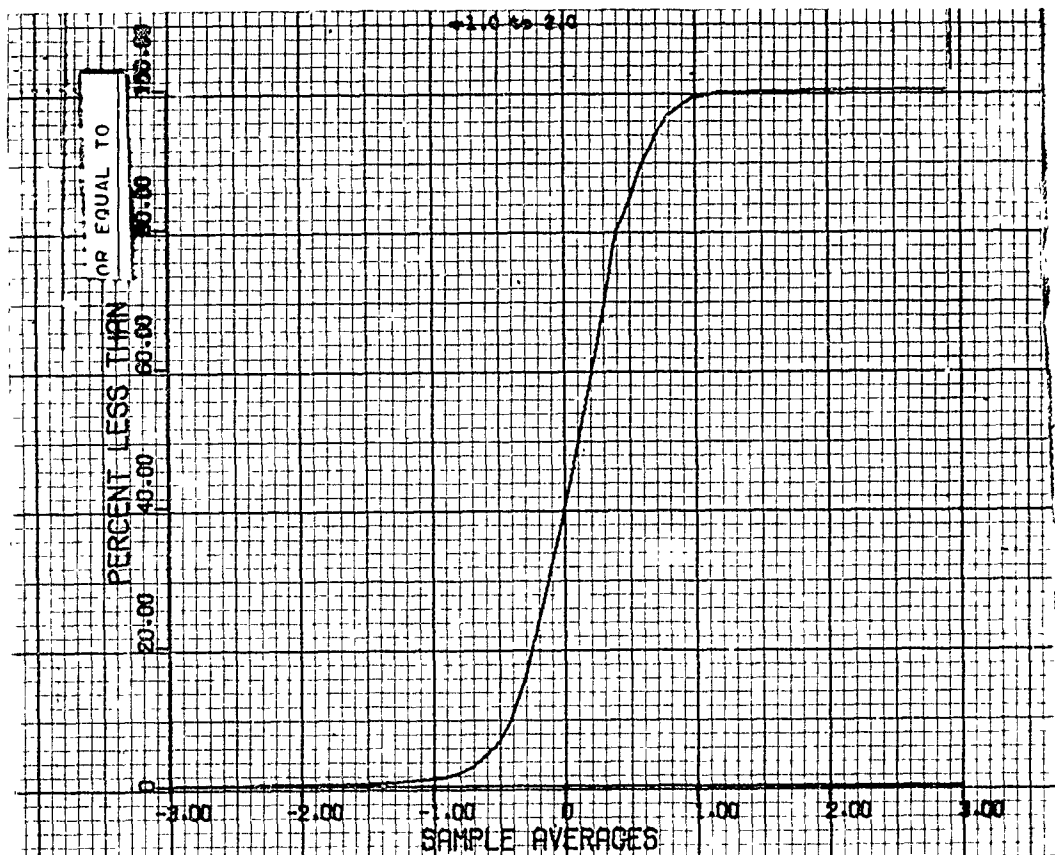


Fig 8-4

THE DATA PROVIDED HEREIN ARE THE RESULTS OF A TRUE 1000 OF 0.0 AND A TRUE STANDARD DEVIATION OF 1.0. A SIMULATED LANGLEI SENSITIVITY TEST WAS PERFORMED USING SAMPLES OF 12, 1000 TIMES. THE MINIMUM AND MAXIMUM GATES WERE 2.00 AND 2.00 RESPECTIVELY. THE SAMPLE PARAMETER DISTRIBUTIONS ARE SHOWN BELOW.

# AVERAGES

INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.00	0.0	-1.10 TO -1.00	4.6	.80 TO .90	16.9	2.70 TO 2.80	0.0
-2.00 TO -1.00	0.0	-1.00 TO -.90	3.4	.90 TO 1.00	7.9	2.80 TO 2.90	0.0
-1.00 TO 0.0	0.0	-.90 TO -.80	1.4	1.00 TO 1.10	1.9	2.90 TO 3.00	0.0
0.0 TO 1.0	0.0	-.80 TO -.70	2.3	1.10 TO 1.20	5.9	3.00 TO 3.10	0.0
1.0 TO 2.0	0.0	-.70 TO -.60	4.6	1.20 TO 1.30	9.9	3.10 TO 3.20	0.0
2.0 TO 3.0	0.0	-.60 TO -.50	15.9	1.30 TO 1.40	9.9	3.20 TO 3.30	0.0
3.0 TO 4.0	0.0	-.50 TO -.40	39.9	1.40 TO 1.50	9.9	3.30 TO 3.40	0.0
4.0 TO 5.0	0.0	-.40 TO -.30	40.9	1.50 TO 1.60	9.9	3.40 TO 3.50	0.0
5.0 TO 6.0	0.0	-.30 TO -.20	55.9	1.60 TO 1.70	9.9	3.50 TO 3.60	0.0
6.0 TO 7.0	0.0	-.20 TO -.10	71.9	1.70 TO 1.80	9.9	3.60 TO 3.70	0.0
7.0 TO 8.0	0.0	-.10 TO 0.0	87.9	1.80 TO 1.90	9.9	3.70 TO 3.80	0.0
8.0 TO 9.0	0.0	0.0 TO .10	93.9	1.90 TO 2.00	9.9	3.80 TO 3.90	0.0
9.0 TO 10.0	0.0	.10 TO .20	91.9	2.00 TO 2.10	9.9	3.90 TO 4.00	0.0
10.0 TO 11.0	0.0	.20 TO .30	80.9	2.10 TO 2.20	9.9	4.00 TO 4.10	0.0
11.0 TO 12.0	0.0	.30 TO .40	79.9	2.20 TO 2.30	9.9	4.10 TO 4.20	0.0
12.0 TO 13.0	0.0	.40 TO .50	63.9	2.30 TO 2.40	9.9	4.20 TO 4.30	0.0
13.0 TO 14.0	0.0	.50 TO .60	37.9	2.40 TO 2.50	9.9	4.30 TO 4.40	0.0
14.0 TO 15.0	0.0	.60 TO .70	27.9	2.50 TO 2.60	9.9	4.40 TO 4.50	0.0
15.0 TO 16.0	0.0	.70 TO .80	6.9	2.60 TO 2.70	9.9	4.50 TO 4.60	0.0
16.0 TO 17.0	0.0	.80 TO .90	95.9				

# STANDARD DEVIATIONS

INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.00	0.0	-1.10 TO -1.00	0.0	.80 TO .90	71.9	2.70 TO 2.80	0.0
-2.00 TO -1.00	0.0	-1.00 TO -.90	0.0	.90 TO 1.00	45.9	2.80 TO 2.90	3.9
-1.00 TO 0.0	0.0	-.90 TO -.80	0.0	1.00 TO 1.10	47.9	2.90 TO 3.00	0.0
0.0 TO 1.0	0.0	-.80 TO -.70	0.0	1.10 TO 1.20	31.9	3.00 TO 3.10	0.0
1.0 TO 2.0	0.0	-.70 TO -.60	0.0	1.20 TO 1.30	24.9	3.10 TO 3.20	2.9
2.0 TO 3.0	0.0	-.60 TO -.50	0.0	1.30 TO 1.40	29.9	3.20 TO 3.30	0.0
3.0 TO 4.0	0.0	-.50 TO -.40	0.0	1.40 TO 1.50	28.9	3.30 TO 3.40	1.9
4.0 TO 5.0	0.0	-.40 TO -.30	0.0	1.50 TO 1.60	14.9	3.40 TO 3.50	0.0
5.0 TO 6.0	0.0	-.30 TO -.20	0.0	1.60 TO 1.70	17.9	3.50 TO 3.60	3.9
6.0 TO 7.0	0.0	-.20 TO -.10	0.0	1.70 TO 1.80	7.9	3.60 TO 3.70	0.0
7.0 TO 8.0	0.0	-.10 TO 0.0	0.0	1.80 TO 1.90	6.9	3.70 TO 3.80	0.0
8.0 TO 9.0	0.0	0.0 TO .10	6.9	1.90 TO 2.00	1.9	3.80 TO 3.90	0.0
9.0 TO 10.0	0.0	.10 TO .20	51.9	2.00 TO 2.10	4.9	3.90 TO 4.00	0.0
10.0 TO 11.0	0.0	.20 TO .30	63.9	2.10 TO 2.20	2.9	4.00 TO 4.10	0.0
11.0 TO 12.0	0.0	.30 TO .40	70.9	2.20 TO 2.30	4.9	4.10 TO 4.20	0.0
12.0 TO 13.0	0.0	.40 TO .50	66.9	2.30 TO 2.40	2.9	4.20 TO 4.30	0.0
13.0 TO 14.0	0.0	.50 TO .60	104.9	2.40 TO 2.50	2.9	4.30 TO 4.40	1.9
14.0 TO 15.0	0.0	.60 TO .70	78.9	2.50 TO 2.60	0.0	4.40 TO 4.50	0.0
15.0 TO 16.0	0.0	.70 TO .80	45.9	2.60 TO 2.70	1.9	4.50 TO 4.60	0.0
16.0 TO 17.0	0.0	.80 TO .90	57.9				

NUMBER OF TIMES IN 1000 IN WHICH

A. THERE WAS NO OFFELAD 42  
B. ITERATIVE PROCESS FAILED 123

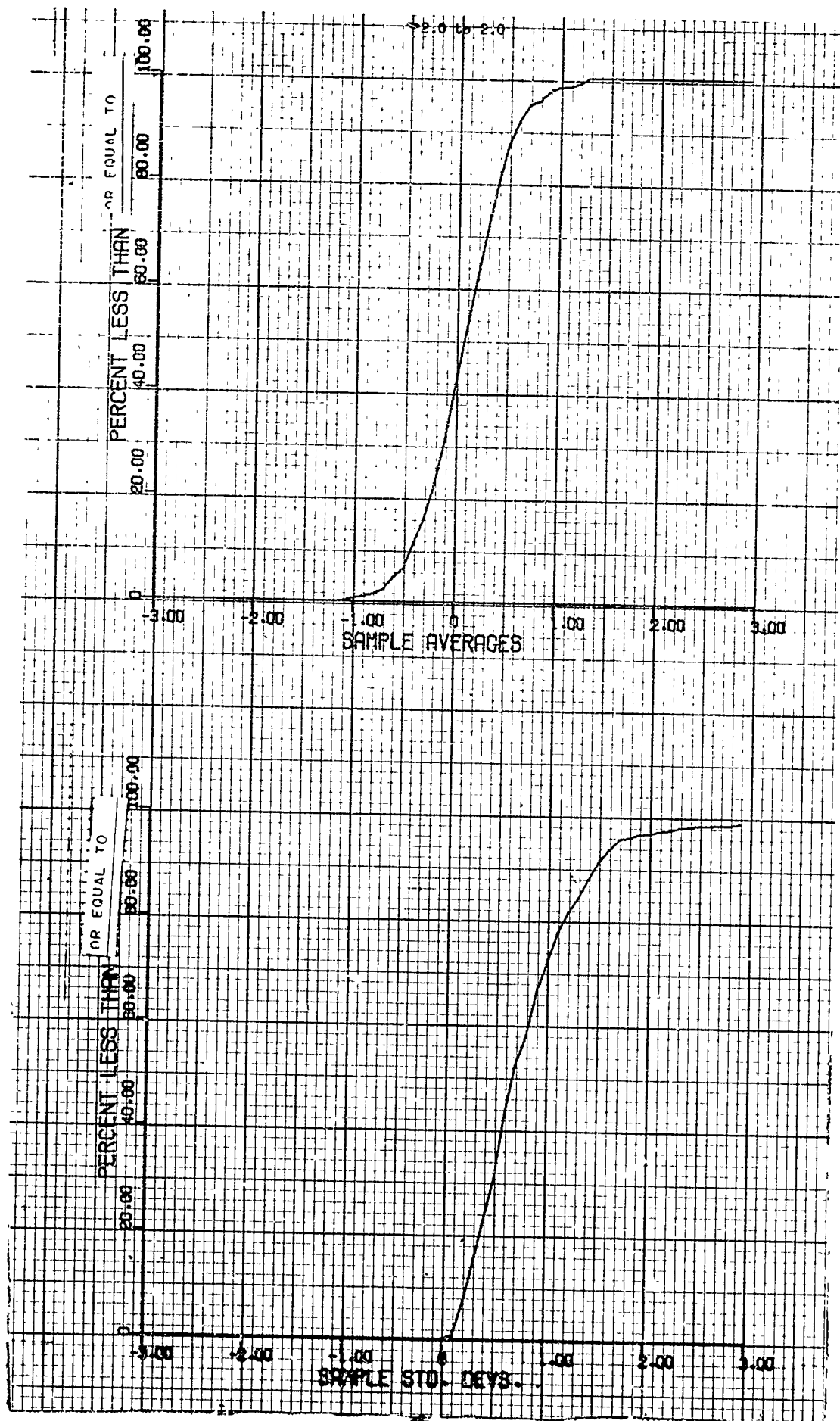


Fig 4-6

V. Sample Statistics: Least Squares Fit of Cumulative Normal Probability Distribution

An alternative method of estimating the average and standard deviation was used with the hope that it would produce better estimates. Although theoretically a least squares fit should not give better results, it was felt that within the narrow constraints of our sample space a better estimate could be made.

Two sample distributions were run. The printouts are shown in the figures following. The results were sufficiently poor in comparison to the maximum likelihood method that further study was abandoned.

\*\*\*\*\*  
 THIS DATA WAS GENERATED USING AN UNCONSTRAINED LEAST SQUARES NORMAL DISTRIBUTION FIT  
 MINIMUM AND MAXIMUM GAITS WERE -5.00 AND 5.00 TRUE VSO = 0.0 WITH STD. DEV. OF 1.0  
 \*\*\*\*\*

AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	1.	12.2	.80 TO .90	1.	87.8	2.70 TO 2.80	0.	100.0
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	12.2	.90 TO 1.00	1.	90.2	2.80 TO 2.90	0.	100.0
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	3.	19.5	1.00 TO 1.10	1.	92.7	2.90 TO 3.00	0.	100.0
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	1.	22.0	1.10 TO 1.20	0.	92.7	3.00 TO 3.10	0.	100.0
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	22.0	1.20 TO 1.30	0.	92.7	3.10 TO 3.20	0.	100.0
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	1.	24.4	1.30 TO 1.40	2.	97.6	3.20 TO 3.30	0.	100.0
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	1.	26.8	1.40 TO 1.50	0.	97.6	3.30 TO 3.40	0.	100.0
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	2.	31.7	1.50 TO 1.60	0.	97.6	3.40 TO 3.50	0.	100.0
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	3.	39.0	1.60 TO 1.70	1.	100.0	3.50 TO 3.60	0.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	39.0	1.70 TO 1.80	0.	100.0	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	2.	43.9	1.80 TO 1.90	0.	100.0	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	1.	46.3	1.90 TO 2.00	0.	100.0	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	1.	48.8	2.00 TO 2.10	0.	100.0	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	0.	48.8	2.10 TO 2.20	0.	100.0	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	3.	56.1	2.20 TO 2.30	0.	100.0	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	7.	73.2	2.30 TO 2.40	0.	100.0	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	2.	4.9	.50 TO .60	2.	78.0	2.40 TO 2.50	0.	100.0	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	1.	7.3	.60 TO .70	3.	85.4	2.50 TO 2.60	0.	100.0	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	1.	9.8	.70 TO .80	0.	85.4	2.60 TO 2.70	0.	100.0	4.50 TO 4.60	0.	100.0

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0.	0.0	-1.10 TO -1.00	0.	0.0	.80 TO .90	0.	80.5	2.70 TO 2.80	0.	97.6
-2.90 TO -2.80	0.	0.0	-1.00 TO -.90	0.	0.0	.90 TO 1.00	2.	85.4	2.80 TO 2.90	0.	97.6
-2.80 TO -2.70	0.	0.0	-.90 TO -.80	0.	0.0	1.00 TO 1.10	0.	85.4	2.90 TO 3.00	0.	97.6
-2.70 TO -2.60	0.	0.0	-.80 TO -.70	0.	0.0	1.10 TO 1.20	3.	92.7	3.00 TO 3.10	0.	97.6
-2.60 TO -2.50	0.	0.0	-.70 TO -.60	0.	0.0	1.20 TO 1.30	1.	95.1	3.10 TO 3.20	0.	97.6
-2.50 TO -2.40	0.	0.0	-.60 TO -.50	0.	0.0	1.30 TO 1.40	0.	95.1	3.20 TO 3.30	0.	97.6
-2.40 TO -2.30	0.	0.0	-.50 TO -.40	0.	0.0	1.40 TO 1.50	1.	97.6	3.30 TO 3.40	0.	97.6
-2.30 TO -2.20	0.	0.0	-.40 TO -.30	0.	0.0	1.50 TO 1.60	0.	97.6	3.40 TO 3.50	0.	97.6
-2.20 TO -2.10	0.	0.0	-.30 TO -.20	0.	0.0	1.60 TO 1.70	0.	97.6	3.50 TO 3.60	1.	100.0
-2.10 TO -2.00	0.	0.0	-.20 TO -.10	0.	0.0	1.70 TO 1.80	0.	97.6	3.60 TO 3.70	0.	100.0
-2.00 TO -1.90	0.	0.0	-.10 TO .00	0.	0.0	1.80 TO 1.90	0.	97.6	3.70 TO 3.80	0.	100.0
-1.90 TO -1.80	0.	0.0	.00 TO .10	16.	39.0	1.90 TO 2.00	0.	97.6	3.80 TO 3.90	0.	100.0
-1.80 TO -1.70	0.	0.0	.10 TO .20	1.	41.5	2.00 TO 2.10	0.	97.6	3.90 TO 4.00	0.	100.0
-1.70 TO -1.60	0.	0.0	.20 TO .30	0.	41.5	2.10 TO 2.20	0.	97.6	4.00 TO 4.10	0.	100.0
-1.60 TO -1.50	0.	0.0	.30 TO .40	9.	63.4	2.20 TO 2.30	0.	97.6	4.10 TO 4.20	0.	100.0
-1.50 TO -1.40	0.	0.0	.40 TO .50	0.	63.4	2.30 TO 2.40	0.	97.6	4.20 TO 4.30	0.	100.0
-1.40 TO -1.30	0.	0.0	.50 TO .60	3.	70.7	2.40 TO 2.50	0.	97.6	4.30 TO 4.40	0.	100.0
-1.30 TO -1.20	0.	0.0	.60 TO .70	2.	75.6	2.50 TO 2.60	0.	97.6	4.40 TO 4.50	0.	100.0
-1.20 TO -1.10	0.	0.0	.70 TO .80	2.	80.5	2.60 TO 2.70	0.	97.6	4.50 TO 4.60	0.	100.0

NUMBER OF TIMES IN 50 IN WHICH  
 A. THERE WAS NO OVERLAP----- 5  
 B. ITERATIVE PROCESS FAILED- 4

Fig 5-1



\*\*\*\*\* THIS DATA WAS GENERATED USING AN UNCONSTRAINED LEAST SQUARES NORMAL DISTRIBUTION FIT. \*\*\*\*\*  
 \*\*\*\*\* MINIMUM AND MAXIMUM GATES WERE -2.00 AND 2.00 TRUE V50 = 0.0 WITH STD. DEV. OF 1.0 \*\*\*\*\*

AVERAGES

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	-.80 TO -.90	1	89.1
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	-.90 TO -1.00	2	93.5
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	-1.00 TO -1.10	0	93.5
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	-1.10 TO -1.20	0	93.5
-2.60 TO -2.50	0	0.0	-.70 TO -.60	1	2.2	-1.20 TO -1.30	1	95.7
-2.50 TO -2.40	0	0.0	-.60 TO -.50	3	8.7	-1.30 TO -1.40	0	95.7
-2.40 TO -2.30	0	0.0	-.50 TO -.40	4	17.4	-1.40 TO -1.50	0	95.7
-2.30 TO -2.20	0	0.0	-.40 TO -.30	4	26.1	-1.50 TO -1.60	0	95.7
-2.20 TO -2.10	0	0.0	-.30 TO -.20	5	37.0	-1.60 TO -1.70	0	95.7
-2.10 TO -2.00	0	0.0	-.20 TO -.10	2	41.3	-1.70 TO -1.80	1	97.8
-2.00 TO -1.90	0	0.0	-.10 TO .00	2	45.7	-1.80 TO -1.90	0	97.8
-1.90 TO -1.80	0	0.0	.00 TO .10	1	47.8	-1.90 TO -2.00	0	97.8
-1.80 TO -1.70	0	0.0	.10 TO .20	4	56.5	-2.00 TO -2.10	0	97.8
-1.70 TO -1.60	0	0.0	.20 TO .30	0	56.5	-2.10 TO -2.20	0	97.8
-1.60 TO -1.50	0	0.0	.30 TO .40	2	60.9	-2.20 TO -2.30	0	97.8
-1.50 TO -1.40	0	0.0	.40 TO .50	5	71.7	-2.30 TO -2.40	0	97.8
-1.40 TO -1.30	0	0.0	.50 TO .60	1	73.9	-2.40 TO -2.50	1	100.0
-1.30 TO -1.20	0	0.0	.60 TO .70	3	80.4	-2.50 TO -2.60	0	100.0
-1.20 TO -1.10	0	0.0	.70 TO .80	3	87.0	-2.60 TO -2.70	0	100.0

STANDARD DEVIATIONS

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	-.80 TO -.90	1	60.9
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	-.90 TO -1.00	6	73.9
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	-1.00 TO -1.10	0	73.9
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	-1.10 TO -1.20	0	73.9
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	-1.20 TO -1.30	0	73.9
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	-1.30 TO -1.40	1	76.1
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	-1.40 TO -1.50	3	82.6
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	-1.50 TO -1.60	0	82.6
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	-1.60 TO -1.70	0	82.6
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	-1.70 TO -1.80	0	82.6
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	-1.80 TO -1.90	0	82.6
-1.90 TO -1.80	0	0.0	.00 TO .10	18	39.1	-1.90 TO -2.00	0	82.6
-1.80 TO -1.70	0	0.0	.10 TO .20	2	43.5	-2.00 TO -2.10	0	82.6
-1.70 TO -1.60	0	0.0	.20 TO .30	1	45.7	-2.10 TO -2.20	1	84.8
-1.60 TO -1.50	0	0.0	.30 TO .40	0	45.7	-2.20 TO -2.30	0	84.8
-1.50 TO -1.40	0	0.0	.40 TO .50	4	54.3	-2.30 TO -2.40	1	87.0
-1.40 TO -1.30	0	0.0	.50 TO .60	0	54.3	-2.40 TO -2.50	0	87.0
-1.30 TO -1.20	0	0.0	.60 TO .70	0	54.3	-2.50 TO -2.60	0	87.0
-1.20 TO -1.10	0	0.0	.70 TO .80	2	58.7	-2.60 TO -2.70	0	87.0

NUMBER OF TIMES IN 50 IN WHICH

A. THERE WAS NO OVERLAP----- 2  
 B. ITERATIVE PROCESS FAILED- 2

VI. Sample Statistics: Least Squares Linear Fit for Average  
followed by Least Squares Fit of Cumulative Normal  
Probability ~~Distribution~~ for Standard Deviation

**DISTRIBUTION**

Hopefully, within the narrow constraints of the Standard Langlie Test Procedure another method may be of value in estimating the average and standard deviation rather than the maximum likelihood method. The method attempted here used a least squares linear fit of the data to determine the average. This average was then used in the determination of a standard deviation which would minimize the sum of squared deviations for a cumulative normal distribution curve. This method has some merit in comparison with the maximum likelihood method. The sample distributions are shown on the following page.

THIS DATA WAS GENERATED USING A LEAST SQUARES TREND LINE TO ESTIMATE V50 AND A  
LEAST SQUARES NORMAL DISTRIBUTION AROUND IT TO ESTIMATE THE STANDARD DEVIATION.

MINIMUM AND MAXIMUM GAITS WERE 0.00 AND 2.00 TRUE V50 = 0.0 WITH STD. DEV. OF 1.0

AVFRAGFS

INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT
-3.00 TO -2.90	3	-1.10 TO -1.00	4	.80 TO .90	17	2.70 TO 2.80	99.3
-2.90 TO -2.80	0	-1.00 TO -.90	11	.90 TO 1.00	1	2.80 TO 2.90	99.4
-2.80 TO -2.70	0	-.90 TO -.80	13	1.00 TO 1.10	2	2.90 TO 3.00	99.7
-2.70 TO -2.60	2	-.80 TO -.70	3	1.10 TO 1.20	2	3.00 TO 3.10	100.0
-2.60 TO -2.50	0	-.70 TO -.60	3	1.20 TO 1.30	1	3.10 TO 3.20	100.0
-2.50 TO -2.40	0	-.60 TO -.50	7	1.30 TO 1.40	0	3.20 TO 3.30	100.0
-2.40 TO -2.30	1	-.50 TO -.40	18	1.40 TO 1.50	0	3.30 TO 3.40	100.0
-2.30 TO -2.20	0	-.40 TO -.30	45	1.50 TO 1.60	0	3.40 TO 3.50	100.0
-2.20 TO -2.10	0	-.30 TO -.20	41	1.60 TO 1.70	0	3.50 TO 3.60	100.0
-2.10 TO -2.00	0	-.20 TO -.10	19	1.70 TO 1.80	0	3.60 TO 3.70	100.0
-2.00 TO -1.90	0	-.10 TO .00	74	1.80 TO 1.90	0	3.70 TO 3.80	100.0
-1.90 TO -1.80	3	.00 TO .10	78	1.90 TO 2.00	0	3.80 TO 3.90	100.0
-1.80 TO -1.70	0	.10 TO .20	119	2.00 TO 2.10	0	3.90 TO 4.00	100.0
-1.70 TO -1.60	0	.20 TO .30	120	2.10 TO 2.20	0	4.00 TO 4.10	100.0
-1.60 TO -1.50	5	.30 TO .40	97	2.20 TO 2.30	0	4.10 TO 4.20	100.0
-1.50 TO -1.40	4	.40 TO .50	52	2.30 TO 2.40	0	4.20 TO 4.30	100.0
-1.40 TO -1.30	5	.50 TO .60	57	2.40 TO 2.50	0	4.30 TO 4.40	100.0
-1.30 TO -1.20	5	.60 TO .70	33	2.50 TO 2.60	0	4.40 TO 4.50	100.0
-1.20 TO -1.10	0	.70 TO .80	20	2.60 TO 2.70	0	4.50 TO 4.60	100.0

Fig 8-1

STANDARD DEVIATIONS

INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT	INTERVAL	FRFQ CUM PCT
-3.00 TO -2.90	0	-1.10 TO -1.00	0	.80 TO .90	8	2.70 TO 2.80	95.2
-2.90 TO -2.80	0	-1.00 TO -.90	0	.90 TO 1.00	52	2.80 TO 2.90	95.2
-2.80 TO -2.70	0	-.90 TO -.80	0	1.00 TO 1.10	18	2.90 TO 3.00	95.2
-2.70 TO -2.60	0	-.80 TO -.70	0	1.10 TO 1.20	10	3.00 TO 3.10	95.2
-2.60 TO -2.50	0	-.70 TO -.60	0	1.20 TO 1.30	18	3.10 TO 3.20	95.2
-2.50 TO -2.40	0	-.60 TO -.50	0	1.30 TO 1.40	8	3.20 TO 3.30	95.2
-2.40 TO -2.30	0	-.50 TO -.40	0	1.40 TO 1.50	1	3.30 TO 3.40	95.2
-2.30 TO -2.20	0	-.40 TO -.30	0	1.50 TO 1.60	9	3.40 TO 3.50	95.2
-2.20 TO -2.10	0	-.30 TO -.20	0	1.60 TO 1.70	0	3.50 TO 3.60	95.2
-2.10 TO -2.00	0	-.20 TO -.10	0	1.70 TO 1.80	0	3.60 TO 3.70	95.3
-2.00 TO -1.90	0	-.10 TO .00	0	1.80 TO 1.90	40	3.70 TO 3.80	95.4
-1.90 TO -1.80	0	.00 TO .10	127	1.90 TO 2.00	5	3.80 TO 3.90	95.4
-1.80 TO -1.70	0	.10 TO .20	117	2.00 TO 2.10	5	3.90 TO 4.00	95.4
-1.70 TO -1.60	0	.20 TO .30	106	2.10 TO 2.20	0	4.00 TO 4.10	95.4
-1.60 TO -1.50	0	.30 TO .40	81	2.20 TO 2.30	3	4.10 TO 4.20	95.4
-1.50 TO -1.40	0	.40 TO .50	54	2.30 TO 2.40	1	4.20 TO 4.30	95.4
-1.40 TO -1.30	0	.50 TO .60	52	2.40 TO 2.50	10	4.30 TO 4.40	95.5
-1.30 TO -1.20	0	.60 TO .70	120	2.50 TO 2.60	0	4.40 TO 4.50	95.5
-1.20 TO -1.10	0	.70 TO .80	0	2.60 TO 2.70	0	4.50 TO 4.60	95.5

NUMBER OF TIMES IN 1000 IN WHICH

A. THERE WAS NO OVERLAP----- 81

B. ITERATIVE PROCESS FAILED-- 21

\*\*\*\*\* THIS DATA WAS GENERATED USING A LEAST SQUARES TREND LINE TO ESTIMATE V50 AND A LEAST SQUARES NORMAL DISTRIBUTION AROUND IT TO ESTIMATE THE STANDARD DEVIATION. \*\*\*\*\*  
 \*\*\*\*\* MINIMUM AND MAXIMUM GATTS WEGF -1.00 AND 2.00 TRUE V50 = 0.0 WITH STD. DEV. OF 1.0 \*\*\*\*\*  
 \*\*\*\*\* AVERAGES \*\*\*\*\*

INTERVAL	FPFO CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.	-1.10 TO -1.00	4.	.80 TO .90	9.	2.70 TO 2.80	0.
-2.90 TO -2.80	0.	-1.00 TO -.90	3.	.90 TO 1.00	5.	2.80 TO 2.90	0.
-2.80 TO -2.70	0.	-.90 TO -.80	4.	1.00 TO 1.10	2.	2.90 TO 3.00	0.
-2.70 TO -2.60	0.	-.80 TO -.70	18.	1.10 TO 1.20	2.	3.00 TO 3.10	0.
-2.60 TO -2.50	0.	-.70 TO -.60	18.	1.20 TO 1.30	0.	3.10 TO 3.20	0.
-2.50 TO -2.40	0.	-.60 TO -.50	24.	1.30 TO 1.40	1.	3.20 TO 3.30	0.
-2.40 TO -2.30	0.	-.50 TO -.40	22.	1.40 TO 1.50	0.	3.30 TO 3.40	0.
-2.30 TO -2.20	0.	-.40 TO -.30	53.	1.50 TO 1.60	1.	3.40 TO 3.50	0.
-2.20 TO -2.10	1.	-.30 TO -.20	78.	1.60 TO 1.70	0.	3.50 TO 3.60	0.
-2.10 TO -2.00	0.	-.20 TO -.10	92.	1.70 TO 1.80	0.	3.60 TO 3.70	0.
-2.00 TO -1.90	0.	-.10 TO .00	74.	1.80 TO 1.90	0.	3.70 TO 3.80	0.
-1.90 TO -1.80	0.	.00 TO .10	105.	1.90 TO 2.00	0.	3.80 TO 3.90	0.
-1.80 TO -1.70	1.	.10 TO .20	95.	2.00 TO 2.10	0.	3.90 TO 4.00	0.
-1.70 TO -1.60	0.	.20 TO .30	101.	2.10 TO 2.20	0.	4.00 TO 4.10	0.
-1.60 TO -1.50	0.	.30 TO .40	76.	2.20 TO 2.30	0.	4.10 TO 4.20	0.
-1.50 TO -1.40	0.	.40 TO .50	50.	2.30 TO 2.40	0.	4.20 TO 4.30	0.
-1.40 TO -1.30	0.	.50 TO .60	48.	2.40 TO 2.50	0.	4.30 TO 4.40	0.
-1.30 TO -1.20	1.	.60 TO .70	28.	2.50 TO 2.60	0.	4.40 TO 4.50	0.
-1.20 TO -1.10	0.	.70 TO .80	17.	2.60 TO 2.70	0.	4.50 TO 4.60	0.
*****	*****	*****	*****	*****	*****	*****	*****

Fig 2

STANDARD DEVIATIONS

INTERVAL	FPFO CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.	-1.10 TO -1.00	0.	.80 TO .90	15.	2.70 TO 2.80	0.
-2.90 TO -2.80	0.	-1.00 TO -.90	0.	.90 TO 1.00	61.	2.80 TO 2.90	0.
-2.80 TO -2.70	0.	-.90 TO -.80	0.	1.00 TO 1.10	32.	2.90 TO 3.00	0.
-2.70 TO -2.60	0.	-.80 TO -.70	0.	1.10 TO 1.20	5.	3.00 TO 3.10	0.
-2.60 TO -2.50	0.	-.70 TO -.60	0.	1.20 TO 1.30	23.	3.10 TO 3.20	0.
-2.50 TO -2.40	0.	-.60 TO -.50	0.	1.30 TO 1.40	1.	3.20 TO 3.30	0.
-2.40 TO -2.30	0.	-.50 TO -.40	0.	1.40 TO 1.50	11.	3.30 TO 3.40	0.
-2.30 TO -2.20	0.	-.40 TO -.30	0.	1.50 TO 1.60	12.	3.40 TO 3.50	0.
-2.20 TO -2.10	0.	-.30 TO -.20	0.	1.60 TO 1.70	0.	3.50 TO 3.60	0.
-2.10 TO -2.00	0.	-.20 TO -.10	0.	1.70 TO 1.80	0.	3.60 TO 3.70	1.
-2.00 TO -1.90	0.	-.10 TO .00	0.	1.80 TO 1.90	36.	3.70 TO 3.80	2.
-1.90 TO -1.80	0.	.00 TO .10	89.	1.90 TO 2.00	1.	3.80 TO 3.90	0.
-1.80 TO -1.70	0.	.10 TO .20	100.	2.00 TO 2.10	0.	3.90 TO 4.00	0.
-1.70 TO -1.60	0.	.20 TO .30	57.	2.10 TO 2.20	7.	4.00 TO 4.10	0.
-1.60 TO -1.50	0.	.30 TO .40	107.	2.20 TO 2.30	1.	4.10 TO 4.20	0.
-1.50 TO -1.40	0.	.40 TO .50	113.	2.30 TO 2.40	1.	4.20 TO 4.30	0.
-1.40 TO -1.30	0.	.50 TO .60	98.	2.40 TO 2.50	0.	4.30 TO 4.40	1.
-1.30 TO -1.20	0.	.60 TO .70	146.	2.50 TO 2.60	0.	4.40 TO 4.50	0.
-1.20 TO -1.10	0.	.70 TO .80	1.	2.60 TO 2.70	0.	4.50 TO 4.60	0.
*****	*****	*****	*****	*****	*****	*****	*****

\*\*\*\*\*  
 MINIMUM OF TIMES IN 1000 IN WHICH  
 A. THERE WAS NO OVERLAP----- 60  
 B. ITERATIVE PROCESS FAILED----- 1

BEST AVAILABLE COPY

THIS DATA WAS GENERATED USING A LEAST SQUARES TRFND LINE TO ESTIMATE V50 AND A  
LEAST SQUARES NORMAL DISTRIBUTION AROUND IT TO ESTIMATE THE STANDARD DEVIATION.  
MINIMUM AND MAXIMUM GATES ARE -2.00 INCH 2.00 TRUE V50 = 0.0 WITH STD. DEV. OF 1.0  
AVERAGES

INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.0	-1.10 TO -1.00	3.0	.80 TO .90	7.0	2.70 TO 2.80	0.0
-2.90 TO -2.80	0.0	-1.00 TO -.90	2.0	.90 TO 1.00	3.0	2.80 TO 2.90	0.0
-2.80 TO -2.70	0.0	-.90 TO -.80	10.0	1.00 TO 1.10	4.0	2.90 TO 3.00	1.0
-2.70 TO -2.60	0.0	-.80 TO -.70	12.0	1.10 TO 1.20	3.0	3.00 TO 3.10	0.0
-2.60 TO -2.50	0.0	-.70 TO -.60	24.0	1.20 TO 1.30	1.0	3.10 TO 3.20	0.0
-2.50 TO -2.40	0.0	-.60 TO -.50	26.0	1.30 TO 1.40	0.0	3.20 TO 3.30	0.0
-2.40 TO -2.30	0.0	-.50 TO -.40	45.0	1.40 TO 1.50	1.0	3.30 TO 3.40	0.0
-2.30 TO -2.20	0.0	-.40 TO -.30	75.0	1.50 TO 1.60	0.0	3.40 TO 3.50	0.0
-2.20 TO -2.10	0.0	-.30 TO -.20	91.0	1.60 TO 1.70	0.0	3.50 TO 3.60	0.0
-2.10 TO -2.00	0.0	-.20 TO -.10	67.0	1.70 TO 1.80	0.0	3.60 TO 3.70	0.0
-2.00 TO -1.90	0.0	-.10 TO .00	91.0	1.80 TO 1.90	0.0	3.70 TO 3.80	0.0
-1.90 TO -1.80	0.0	.00 TO .10	108.0	1.90 TO 2.00	0.0	3.80 TO 3.90	0.0
-1.80 TO -1.70	0.0	.10 TO .20	95.0	2.00 TO 2.10	0.0	3.90 TO 4.00	0.0
-1.70 TO -1.60	0.0	.20 TO .30	86.0	2.10 TO 2.20	0.0	4.00 TO 4.10	0.0
-1.60 TO -1.50	0.0	.30 TO .40	66.0	2.20 TO 2.30	0.0	4.10 TO 4.20	0.0
-1.50 TO -1.40	0.0	.40 TO .50	43.0	2.30 TO 2.40	0.0	4.20 TO 4.30	0.0
-1.40 TO -1.30	0.0	.50 TO .60	34.0	2.40 TO 2.50	0.0	4.30 TO 4.40	0.0
-1.30 TO -1.20	0.0	.60 TO .70	20.0	2.50 TO 2.60	0.0	4.40 TO 4.50	0.0
-1.20 TO -1.10	0.0	.70 TO .80	14.0	2.60 TO 2.70	0.0	4.50 TO 4.60	0.0

Fig 6-3

STANDARD DEVIATIONS

INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT	INTERVAL	FREQ CUM PCT
-3.00 TO -2.90	0.0	-1.10 TO -1.00	0.0	.90 TO 1.00	12.0	2.70 TO 2.80	0.0
-2.90 TO -2.80	0.0	-1.00 TO -.90	0.0	.90 TO 1.00	83.0	2.80 TO 2.90	0.0
-2.80 TO -2.70	0.0	-.90 TO -.80	0.0	1.00 TO 1.10	27.0	2.90 TO 3.00	0.0
-2.70 TO -2.60	0.0	-.80 TO -.70	0.0	1.10 TO 1.20	17.0	3.00 TO 3.10	0.0
-2.60 TO -2.50	0.0	-.70 TO -.60	0.0	1.20 TO 1.30	16.0	3.10 TO 3.20	0.0
-2.50 TO -2.40	0.0	-.60 TO -.50	0.0	1.30 TO 1.40	9.0	3.20 TO 3.30	0.0
-2.40 TO -2.30	0.0	-.50 TO -.40	0.0	1.40 TO 1.50	15.0	3.30 TO 3.40	0.0
-2.30 TO -2.20	0.0	-.40 TO -.30	0.0	1.50 TO 1.60	29.0	3.40 TO 3.50	0.0
-2.20 TO -2.10	0.0	-.30 TO -.20	0.0	1.60 TO 1.70	0.0	3.50 TO 3.60	0.0
-2.10 TO -2.00	0.0	-.20 TO -.10	0.0	1.70 TO 1.80	0.0	3.60 TO 3.70	0.0
-2.00 TO -1.90	0.0	-.10 TO .00	0.0	1.80 TO 1.90	30.0	3.70 TO 3.80	0.0
-1.90 TO -1.80	0.0	.00 TO .10	37.0	1.90 TO 2.00	3.0	3.80 TO 3.90	0.0
-1.80 TO -1.70	0.0	.10 TO .20	56.0	2.00 TO 2.10	9.0	3.90 TO 4.00	0.0
-1.70 TO -1.60	0.0	.20 TO .30	81.0	2.10 TO 2.20	8.0	4.00 TO 4.10	0.0
-1.60 TO -1.50	0.0	.30 TO .40	49.0	2.20 TO 2.30	1.0	4.10 TO 4.20	0.0
-1.50 TO -1.40	0.0	.40 TO .50	122.0	2.30 TO 2.40	4.0	4.20 TO 4.30	0.0
-1.40 TO -1.30	0.0	.50 TO .60	45.0	2.40 TO 2.50	10.0	4.30 TO 4.40	0.0
-1.30 TO -1.20	0.0	.60 TO .70	179.0	2.50 TO 2.60	0.0	4.40 TO 4.50	0.0
-1.20 TO -1.10	0.0	.70 TO .80	69.0	2.60 TO 2.70	0.0	4.50 TO 4.60	0.0

MINIMUM OF TIMES IN LINE IN WHICH  
A. THERE WAS NO OVERLAP  
B. ITERATIVE PROCESS FAILED

\*\*\*\*\*  
 THIS DATA WAS GENERATED USING A LEAST SQUARES TRIMMED LINE TO ESTIMATE V50 AND A  
 LEAST SQUARES NORMAL DISTRIBUTION AROUND IT TO ESTIMATE THE STANDARD DEVIATION.  
 MINIMUM AND MAXIMUM VALUES WERE 5.00 INCH V50 = 6.0 WITH STD. DEV. OF 1.0  
 \*\*\*\*\*  
 AVERAGES  
 \*\*\*\*\*

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	4	17.9	2.70 TO 2.80	0	100.0
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	9	26.9	2.80 TO 2.90	0	100.0
-2.80 TO -2.70	0	0.0	-.90 TO -.80	4	30.9	2.90 TO 3.00	0	100.0
-2.70 TO -2.60	0	0.0	-.80 TO -.70	21	51.9	3.00 TO 3.10	0	100.0
-2.60 TO -2.50	0	0.0	-.70 TO -.60	7	58.9	3.10 TO 3.20	0	100.0
-2.50 TO -2.40	0	0.0	-.60 TO -.50	33	91.9	3.20 TO 3.30	0	100.0
-2.40 TO -2.30	0	0.0	-.50 TO -.40	61	98.9	3.30 TO 3.40	0	100.0
-2.30 TO -2.20	0	0.0	-.40 TO -.30	67	99.9	3.40 TO 3.50	0	100.0
-2.20 TO -2.10	0	0.0	-.30 TO -.20	61	100.0	3.50 TO 3.60	0	100.0
-2.10 TO -2.00	0	0.0	-.20 TO -.10	60	100.0	3.60 TO 3.70	0	100.0
-2.00 TO -1.90	0	0.0	-.10 TO .00	99	100.0	3.70 TO 3.80	0	100.0
-1.90 TO -1.80	0	0.0	.00 TO .10	92	100.0	3.80 TO 3.90	0	100.0
-1.80 TO -1.70	0	0.0	.10 TO .20	68	100.0	3.90 TO 4.00	0	100.0
-1.70 TO -1.60	0	0.0	.20 TO .30	55	100.0	4.00 TO 4.10	0	100.0
-1.60 TO -1.50	0	0.0	.30 TO .40	42	100.0	4.10 TO 4.20	0	100.0
-1.50 TO -1.40	0	0.0	.40 TO .50	52	100.0	4.20 TO 4.30	0	100.0
-1.40 TO -1.30	1	.1	.50 TO .60	36	100.0	4.30 TO 4.40	0	100.0
-1.30 TO -1.20	0	.1	.60 TO .70	28	100.0	4.40 TO 4.50	0	100.0
-1.20 TO -1.10	1	.2	.70 TO .80	16	100.0	4.50 TO 4.60	0	100.0

Fig 6-4

INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT	INTERVAL	FREQ	CUM PCT
-3.00 TO -2.90	0	0.0	-1.10 TO -1.00	0	0.0	2.70 TO 2.80	0	100.0
-2.90 TO -2.80	0	0.0	-1.00 TO -.90	0	0.0	2.80 TO 2.90	0	100.0
-2.80 TO -2.70	0	0.0	-.90 TO -.80	0	0.0	2.90 TO 3.00	0	100.0
-2.70 TO -2.60	0	0.0	-.80 TO -.70	0	0.0	3.00 TO 3.10	0	100.0
-2.60 TO -2.50	0	0.0	-.70 TO -.60	0	0.0	3.10 TO 3.20	0	100.0
-2.50 TO -2.40	0	0.0	-.60 TO -.50	0	0.0	3.20 TO 3.30	0	100.0
-2.40 TO -2.30	0	0.0	-.50 TO -.40	0	0.0	3.30 TO 3.40	0	100.0
-2.30 TO -2.20	0	0.0	-.40 TO -.30	0	0.0	3.40 TO 3.50	0	100.0
-2.20 TO -2.10	0	0.0	-.30 TO -.20	0	0.0	3.50 TO 3.60	0	100.0
-2.10 TO -2.00	0	0.0	-.20 TO -.10	0	0.0	3.60 TO 3.70	0	100.0
-2.00 TO -1.90	0	0.0	-.10 TO .00	0	0.0	3.70 TO 3.80	0	100.0
-1.90 TO -1.80	0	0.0	.00 TO .10	36	97.4	3.80 TO 3.90	0	100.0
-1.80 TO -1.70	0	0.0	.10 TO .20	20	99.4	3.90 TO 4.00	0	100.0
-1.70 TO -1.60	0	0.0	.20 TO .30	5	99.9	4.00 TO 4.10	0	100.0
-1.60 TO -1.50	0	0.0	.30 TO .40	39	99.9	4.10 TO 4.20	0	100.0
-1.50 TO -1.40	0	0.0	.40 TO .50	165	100.0	4.20 TO 4.30	0	100.0
-1.40 TO -1.30	0	0.0	.50 TO .60	6	100.0	4.30 TO 4.40	0	100.0
-1.30 TO -1.20	0	0.0	.60 TO .70	267	100.0	4.40 TO 4.50	0	100.0
-1.20 TO -1.10	0	0.0	.70 TO .80	0	100.0	4.50 TO 4.60	0	100.0

NUMBER OF TRIPS IN WHICH  
 THERE WAS NO OVERLAP  
 A. ITERATIVE PROCESS FAILED

\*\*\*\*\*  
 THIS DATA WAS GENERATED USING A LEAST SQUARES TRIMMED LINE TO ESTIMATE V50 AND A  
 LEAST SQUARES NORMAL DISTRIBUTION AROUND IT TO ESTIMATE THE STANDARD DEVIATION.  
 MINIMUM AND MAXIMUM VALUES WERE 5.00 INCH V50 = 6.0 WITH STD. DEV. OF 1.0  
 \*\*\*\*\*  
 AVERAGES  
 \*\*\*\*\*

## VII. Comparison of Three Estimating Methods

On the following pages gross comparisons of the three estimating methods attempted are made. In general, the standard method of maximum likelihood is best, although there are times, as shown in Figure 7-1, when the maximum likelihood computer program does not give answers while the method described in Section VI does.

Comparison of Methods Used to Estimate the  
Average and Standard Deviation

	Initial Guesses (In Standard Deviations)	
	Maximum Likelihood	0 to +2 Least Squares Linear Average and Least Squares Normal Std. Dev.
Averages		
Average	-.05	.09
Standard Deviation	.61	.51
Number of Values used from printout	467	865
Number of extreme values not used	21	33
Standard Deviations		
Average	.77	.57
Standard Deviation	.85	.57
Number of Values used from printout	463	858
Number of extreme values not used	25	40
Standard Deviation/Average	1.10	1.00
Total Simulations Attempted	1000	1000
Number of simulations not used due to		
No overlap	68	81
Iterative process failed	444	21

Fig. 7-1



Comparison of Methods Used to Estimate the  
Average and Standard Deviation

Initial Guesses (In Standard Deviations)

	Maximum Likelihood	-1 to +2 Least Squares Linear Average and Least Squares Normal Std. Dev.
Averages		
Average	-.03	.06
Standard Deviation	.38	.39
Number of Values used from printout	849	933
Number of extreme values not used	1	6
Standard Deviations		
Average	.61	.62
Standard Deviation	.49	.53
Number of Values used from printout	844	930
Number of extreme values not used	6	9
Standard Deviation/Average	.80	.85
Total Simulations Attempted	1000	1000
Number of simulations not used due to		
No overlap	53	60
Iterative process failed	97	1

Fig. 7-2

Comparison of Methods Used to Estimate the  
Average and Standard Deviation

Initial Guesses (In Standard Deviations)

	Maximum Likelihood	-2 to +2 Least Squares Linear Average and Least Square Normal Std. Dev.	Unconstrained Least Squares Normal Distri- bution
Averages			
Average	-.03	.01	.21
Standard Deviation	.39	.40	.65
Number of values used from printout	886	935	46
Number of extreme values not used	0	0	0
Standard Deviations			
Average	.71	.72	.81
Standard Deviation	.51	.55	.98
Number of values used from printout	884	933	45
Number of extreme values not used	2	2	1
Standard Deviation/ Average	.72	.76	1.21
Total Simulations Attempted	1000	1000	50
Number of simulations not used due to			
No overlap	65	65	2
Iterative process failed	49	0	2

Fig. 7-3

Comparison of Methods Used to Estimate the  
Average and Standard Deviation

Initial Guesses (In Standard Deviations)

	Maximum Likelihood	-5 to +5 Least Squares Linear Average and Least Squares Normal Std. Dev.	Unconstrained Least Squares Normal Distri- bution
Averages			
Average	-.01	.02	.07
Standard Deviation	.40	.42	.77
Number of values used from printout	829	888	41
Number of extreme values not used	0	0	0
Standard Deviations			
Average	.77	.84	.49
Standard Deviation	.42	.51	.64
Number of values used from printout	829	888	41
Number of extreme values not used	0	0	0
Standard Deviation/ Average	.55	.61	1.31
Total Simulations Attempted	1000	1000	50
Number of simulations not used due to			
No overlap	135	112	5
Iterative process failed	36	0	4

Fig. 7-4

### VIII. Applications of Derived Statistics

Shown below are two examples using the derived statistics.

1. Given that an ammunition item has a true average penetration velocity of 800 and a standard deviation of 60, what is the best estimate of the lowest sample average that can be obtained with 90% confidence. It is assumed the upper and lower gates are 680 and 920.

Convert the upper and lower limit to standard deviations by taking the differences from the mean and dividing by the standard deviation. This gives values of -2.0 and 2.0. Look up the graph on Fig. 2-16. The 90% confidence level will be indicated by that point on the graph which has 10 percent or less chance of occurrence. This value in standard deviations is roughly -.5. Multiplying this number by the standard deviation and summing with the average gives the solution as 770.

2. Given the same problem as above but assuming a 10% random malfunction rate. Look up graph on Fig. 4-6. The value in standard deviations is roughly .45, giving a solution of 773. A higher velocity which will yield a lower effective range.

## APPENDIX A

## PROCEDURES FOR DETERMINING THE AVERAGE ( $V_{50}$ )

1. Establish a lower and upper velocity such that:
  - a. The probability of obtaining a complete penetration at the higher velocity is highly likely.
  - b. The probability of obtaining a complete penetration at the lower velocity is highly unlikely.
2. Fire the first round at a velocity midway between these two limits.
3. If the first round results in an ~~an~~ <sup>INCOMPLETE</sup> penetration, fire the second round halfway between the first round velocity and the upper limit velocity; otherwise, halfway between the first and lower limit velocity.
4. If the first two rounds result in a reversal (one partial, one complete), fire the third round midway between the velocity of the first two rounds. If the first two rounds result in two partials, fire the third round at a velocity midway between the second round velocity and the <sup>upper</sup> limit velocity. If the first two rounds result in two completes, fire the third round midway between the second round velocity and the ~~lower~~ <sup>lower</sup> limit velocity.
5. Succeeding rounds are fired using the following rules:
  - a. If the preceding pair of rounds resulted in a reversal (one partial, one complete), fire at a velocity midway between them.
  - b. If the last two rounds did not produce a reversal, look at the last four rounds. If the number of completes and partials are equal, fire the next round midway between the velocity of the first and last round of the group. If the last four did not produce equal numbers of partials and completes, look at the last six, eight, etc., until the number of partials and completes is equal. Always fire at a velocity midway between the first and last round of the group you examined.
  - c. In the event that conditions in b above cannot be satisfied, if the last round resulted in a complete, fire the next round at a velocity midway between the last round and the ~~lower~~ <sup>lower</sup> velocity limit; otherwise (last round is a partial) midway between the velocity of the last round and the <sup>upper</sup> limit.

d. Proceed as in a and b above.

e. Firing will terminate when 12 rounds have been fired.

f. In the event that the firing does not produce a zone of mixed results, the average will be computed by averaging the highest complete and lowest partial.

g. In the event that the firing produces a zone of mixed results, computation of the average will be performed by using the cumulative normal and the principle of maximum likelihood.

**SUPPLEMENTARY**

**INFORMATION**



2/24/78

ADDITIONAL ERRATA ATTACHED.

AD A052225

REPORT NO. QAR-Q-011



COMPUTER SIMULATION OF MAXIMUM  
LIKELIHOOD OUTPUT FOR STANDARD

LANGLIE TEST  
( $n=12$ )

DONALD C. RAPPAFORT

DECEMBER 1977

ARTILLERY SYSTEMS DIVISION  
PRODUCT ASSURANCE DIRECTORATE ✓

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND  
DOVER, NEW JERSEY

## PROCEDURES FOR DETERMINING THE AVERAGE ( $V_{50}$ )

1. Establish a lower and upper velocity such that:
  - a. The probability of obtaining a complete penetration at the higher velocity is highly likely.
  - b. The probability of obtaining a complete penetration at the lower velocity is highly unlikely.
2. Fire the first round at a velocity midway between these two limits.
3. If the first round results in an ~~an~~ <sup>INCOMPLETE</sup> penetration, fire the second round halfway between the first round velocity and the upper limit velocity; otherwise, halfway between the first and lower limit velocity.
4. If the first two rounds result in a reversal (one partial, one complete), fire the third round midway between the velocity of the first two rounds. If the first two rounds result in two partials, fire the third round at a velocity midway between the second round velocity and the <sup>Upper</sup> limit velocity. If the first two rounds result in two completes, fire the third round midway between the second round velocity and the ~~lower~~ limit velocity.
5. Succeeding rounds are fired using the following rules:
  - a. If the preceding pair of rounds resulted in a reversal (one partial, one complete), fire at a velocity midway between them.
  - b. If the last two rounds did not produce a reversal, look at the last four rounds. If the number of completes and partials are equal, fire the next round midway between the velocity of the first and last round of the group. If the last four did not produce equal numbers of partials and completes, look at the last six, eight, etc., until the number of partials and completes is equal. Always fire at a velocity midway between the first and last round of the group you examined.
  - c. In the event that conditions in b above cannot be satisfied, if the last round resulted in a complete, fire the next round at a velocity midway between the last round and the ~~lower~~ velocity limit; otherwise (last round is a partial) midway between the velocity of the last round and the <sup>upper</sup> limit.

ERRATA SHEETS

PAGE 6. THIRD LINE IN TITLE "PROBABILITY  
DEVIATION -- ", SHOULD BE "PROBABILITY DISTRIBUTION...."

REPORT NO. QAR-Q-011

COMPUTER SIMULATION OF MAXIMUM  
LIKELIHOOD OUTPUT FOR STANDARD  
LANGLIE TEST  
( $n=12$ )

DONALD C. RAPPAPORT

DECEMBER 1977

# Selected Summary of Computer Printouts

	Initial		Estimates (In standard deviations)			
	-5	-2	-2	-1	0	-0.5
	to	to	to	to	to	to
	+5	+3	+2	+2	+2	+0.5
Averages						
Average	-.01	-.01	-.03	-.03	-.05	-.04
Standard Deviation	.40	.39	.39	.38	.61	.42
Number of values used from printout	<del>819</del> 829	827	<del>826</del> 826	849	467	757
Number of extreme values not used	0	0	0	1	21	4
Standard Deviations						
Average	.77	.69	.71	.61	.77	.39
Standard Deviation	.42	.38	.51	.49	.85	.47
Number of values used from printout	<del>829</del> 829	825	884	844	463	753
Number of extreme values not used	0	2	2	6	25	8
Standard Deviation/Average	.55	.70	.72	.80	1.10	1.21
Total Simulations Attempted	1000	1000	1000	1000	1000	1000
Number of simulations not used due to						
No overlap	135	95	65	53	68	52
Iterative process failed	36	78	49	97	444	187

Fig. 2-1

Comparison of Methods Used to Estimate the  
Average and Standard Deviation

Initial Guesses (In Standard Deviations)

	Maximum Likelihood	-5 to +5 Least Squares Linear Average and Least Squares Normal Std. Dev.	Unconstrained Least Squares Normal Distri- bution
Averages			
Average	-.01	.02	.07
Standard Deviation	.40	.42	.77
Number of values used from printout	<del>829</del> 888	888	41
Number of extreme values not used	0	0	0
Standard Deviations			
Average	.77	.84	.49
Standard Deviation	.42	.51	.64
Number of values used from printout	<del>829</del> 888	888	41
Number of extreme values not used	0	0	0
Standard Deviation/ Average	.55	.61	1.31
Total Simulations Attempted	1000	1000	50
Number of simulations not used due to			
No overlap	135	112	5
Iterative process failed	36	0	4

Fig. 7-4